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HENRY MADISON KENDALL, Editor, Dept. of Geography, Miami University, Oxford, Ohio

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TITUS SMITH, JUNIOR, AND THE GEOGRAPHY OF NOVA SCOTIA IN 1801 AND 1802*

ANDREW H. CLARK
University of Wisconsin

WE rightly emphasize the importance of direct observation in geographical investigation and interpretation. This emphasis does not imply a conflict between the library and the field as locales for geographical study; each problem has its own most appropriate methodology of solution. Yet there remain few kinds of such study in which sound description and reasoned conclusion are not dependent on first hand visits to the areas concerned. That this circumstance poses a particularly difficult problem for the historical geographer is obvious enough, and has given rise to an emphasis on the importance of contemporary field work in his investigations.[1] Yet, no matter how assiduously he checks the documents and maps of another day in the field or searches for evidence of the past in the present landscape, he has found thereby no really satisfactory substitute for actually seeing the land as it was. Indeed he is exposed to a grave danger, which is too little recognized, to the logical basis of his work.

This danger is risked in attempts to reconstruct the past almost solely by obser- and interpretation of the present. If the historical geographer were, in fact, interested in reconstruction of the past only for some antiquarian purpose this danger would be less serious. It is increasingly evident, however, that historical geographers have a much deeper purpose than this; their larger aim is to understand the geography of the present by study of the changing geography of the past. But if that reconstruction depends largely on a known base of present geography it would be the grossest perversion of scientific method to follow the same reasoning in reverse to explain the present largely in terms of a past reconstructed from it, that is, essentially, in terms of itself. Such a pendulum swing back and forth along the same line of reasoning is a stimulating mental exercise, but proves little or nothing. Rather must we reconstruct past geography as largely as possible from independent

* The author wishes to express his thanks to Dr. D. C. Harvey of the Provincial Archives of Nova Scotia, the Rutgers University Research Council, the Nova Scotia Research Foundation, and the University of Wisconsin Research Committee for making this paper possible.

[1] Andrew H. Clark, "Field research in historical geography," *The Professional Geographer* (Old Series), IV (1946): 13–22.

evidence if we are to describe its changing character through time satisfactorily and to draw useful conclusions therefrom. In attempting to see the area of his interest as it was, the best view for the historical geographer is through the eyes of observers contemporary with the time of his interest. Yet for most areas, for most periods of the past, the eyes on which he must depend are misty, myopic, and, above all, untrained to notice and record what the geographer so urgently wants to know. The study of various problems in the changing geography of Maritime Canada over a period of three centuries, which has engaged the writer's attention for some years, has left a legacy of hard-earned cynicism about the competence and accuracy of most past observers of the area who have made any effort to record what they have seen. Some—Lescarbot,[2] Denys,[3] and the Yorkshiremen, Robinson and Rispin,[4] for example—are justly famed, but many of the others, including some who were most prolix, are interesting only to the point where one takes their reports and maps into the field to try to reconcile what was said to be there with what experience, common sense, and other evidence tell one could have been there at the time.

We do not, of course, demand an omnibus social and natural scientist with the peculiar bias and training of a mid-twentieth century professional geographer. We may dream, but may rarely hope, even for the gifted eyes and pen of a Smollett, a Kalm, a Banks, or a Humboldt.[5] Yet there were lesser men than these, in other times and places, who observed and though and wrote as we may only hope our own powers may grant us to do. Students familiar with sources for the geography of eastern North America in the early years of the United States are aware that we have many such unsung geographers on whom we may depend.[6] Indeed the early

[2] Marc Lescarbot (or L'Escarbot) accompanied De Monts and Poutrincourt on the former's second voyage to Acadia in 1606, and has left us our earliest detailed descriptions of the first permanent European settlement in the new world north of Florida in his *Nova Francia, a Description of Acadia, 1606* (New York, 1928), which has been published dozens of times in many languages since the early 17th century.

[3] Nicholas Denys spent most of the 17th century in "Acadia," especially in Cape Breton and along the southern shores of the Gulf of St. Lawrence. His *Description Géographique et Historique des Costes de l'Amérique Septentrionale* (Paris, 1672) is perhaps most easily available in translation in the Champlain Society's publication, *The description and natural history of the coasts of Nova Scotia* (Toronto, 1922).

[4] John Robinson and Thomas Rispin, *Journey through Nova Scotia* . . . (York, 1774) reprinted in *Public Archives of Nova Scotia, Report for 1944* (Halifax, 1945), Appendix B, pp. 27–57.

[5] Tobias George Smollett, *Travels through France and Italy* . . . (London, 1766) has been one of the most extensively reprinted travel books of all time. The most useful and available edition of Per Kalm's classic is *The America of 1750: Peter Kalm's travels in North America; the English version of 1770, revised from the original Swedish and edited by Adolph B. Benson . . . with a translation of new material from Kalm's notes* . . . (New York, 1937). Sir Joseph Banks' *Journal . . . during Captain Cook's First Voyage* . . . was finally published in London in 1896. The choice here of Alexander von Humboldt's vast production is his and Aimé Bonpland's *Voyage aux Régions équinoxiales du Nouveau Continent, fait en 1799-1804* . . . (Paris, 1814), republished many times in French, English and other languages.

[6] The bibliography in Ralph Hall Brown's *Mirror for Americans* . . . (New York, 1943) is particularly rich in examples.

19th century in the Old Northwest has left us almost an embarrassment of riches in certain respects; Schoolcraft and Flint were far from unique in their place and time.[7] It therefore has been a grave disappointment that, for a period of several decades, in the critical times near the beginning of the nineteenth century, no reliable, geographically minded observer had, apparently, left such a usable record of Nova Scotia. Some recent discoveries have allowed a substantial part of this gap to be filled and their significance to the reconstruction of the geography of Nova Scotia a century and a half ago has been great. Because of this significance, and because they illustrate so well the importance of reliable first hand geographical observation of any area for any period in which one may be interested, they deserve the attention of geographers.

These discoveries relate to the work of Titus Smith, junior, of Nova Scotia, recognized here as a geographer unquestionably for the first time. If he knew the name "geographer" it was as a designation of surveyors and map-makers. As such he could have made some small claim to the title, but it would never have occurred to him to do so. He was a farmer by occupation; a surveyor by avocation; a scientist, philosopher, and writer for recreation. Looking at the Nova Scotia of a century and a half ago through his eyes for some time, and taking his journals into the field, following or crossing his trail on dozens of occasions, have made clear what an extraordinarily competent geographer he was.

Upon investigation it appears that his training might well be the envy of a modern geographer although little of it, after an excellent boyhood schooling in the classics, was formal, or in a classroom. So much of it derived from his father's wide knowledge and insatiable curiosity that it may be well first to introduce that worthy gentleman.[8]

Titus Smith, senior, was a native of Massachusetts who had fought in the French wars in Upper New York in 1756–7, been graduated from Yale College in 1764, studied dialects of the Six Nations' Indians, been ordained to the ministry, and finally sent as a missionary to the Indians. Finding the Mohawk Valley then, as always, a highly competitive area (even for souls) he shortly left the field to his rivals and became an itinerant preacher in southern New England. In turn he studied medicine, botany, mathematics, and chemistry.[9] Then, as a Tory,[10] the

[7] Henry Rowe Schoolcraft's too little known *Journal of a tour into the interior of Missouri and Arkansaw from Potosi, or Mine a Burton . . .* (London, 1821) and Timothy Flint, *Recollections of the Last Ten Years passed in Occasional Residences and Journeyings in the valley of the Mississippi* (Boston, 1826) are the items in mind.

[8] This account of Titus Smith, senior, and the early years of his son is based on a number of scattered records, including Smith's own writings; Mrs. William Lawson's *History of the Townships of Dartmouth, Preston and Lawrencetown* (Halifax, 1893); the contemporary Halifax press; but especially on a detailed study by the late Harry Piers, *Titus Smith, "The Dutch Village Philosopher," Pioneer Naturalist of Nova Scotia, 1768–1850* (Halifax, 1938).

[9] He shared with Benjamin Franklin and Thomas Jefferson (and of course many other colonial Americans) the pleasure and instruction of correspondence with the great Dr. Joseph Priestley.

[10] Smith became a Glassite (the members of the sect in America were usually called Sande-

Reverend Smith and his family took refuge in Long Island during the Revolution and joined the evacuees from New York to Halifax in 1783. In Nova Scotia he was recognized as one of the honored Loyalists and received a grant of land in the new Township of Preston near Dartmouth, across harbor from Halifax. There the son, our geographer, now fifteen and a precocious sharer of his father's wide interests, completed his education in his father's ample library (which included, soon, a full set of the works of Linnaeus), in the experimental garden plot where many new plants were introduced and new methods tried,[11] and in roaming the fields and forests of his adopted land learning to see and understand with a naturalist's trained eye and mind.

In the last decade of the century, while in his twenties, Titus junior became a land surveyor, a profession he followed intermittently until his death in 1850. In 1801, the governor of the colony commissioned him to make a survey on the results of which his claims to our attention are solidly based. To understand its full significance, however, we must first have a glimpse at the circumstances of the colony at the time.

By the somewhat casual decisions of one of the many "peace" or "truce" settlements which interrupted successive episodes of the two-century conflict between the French and British empires in North America, peninsular Nova Scotia came under permanent British control in 1713.[12] France retained control, on and off, of the islands of Prince Edward and Cape Breton (then Îles St. Jean and Royale) and exercised effective, if disputed, sovereignty of the Acadian "mainland"[13] for another half century. For nearly half a century, however, British control of the peninsula consisted of the threat of naval action, a small garrison at Annapolis Royal (old Acadian Port Royal), and little else. The many thousands of Acadian settlers continued to enjoy the fruits of their labors in the dyked tidal lands bordering the Annapolis, Minas, and Chignecto basins and their tributary estuaries. On the northern, eastern, southern, and southwestern coasts European and New England fishermen continued to make their temporary settlements, usually seasonal but some-

manians) in 1768. The American Glassites were almost universally Royalists, by some involved extension of the Rev. John Glas' original principle that civil magistrates had no authority in the church. Smith was ordained in his new sect as an unpaid minister (elder) and served as such in Nova Scotia where he lived until his death in 1807.

[11] There is a reference to the Smith garden in 1791 in the Journal of a visitor of that year, quoted in Nova Scotia Historical Society, *Collections for 1889–91*, VII (Halifax, 1891): 139. The writer, one Clarkson, adds "This man is an excellent botanist and lays out part of his garden for experiments." The identification of the "man" as Smith was made by Piers, *op cit.*, 1938.

[12] The treaty of Utrecht.

[13] Now the province of New Brunswick. At the end of the struggle, British and French forts (Lawrence and Beausejour—later Cumberland) faced each other in parallel ridges rising above the great Tantramar marshes on the isthmus of Chignecto. Between them flowed the tidal Missiguash River, later to be the southern part of the boundary between the two provinces of Nova Scotia and New Brunswick, throwing the greater part of the tidal marsh area to the latter.

times lasting over a winter or two, as they had done since the sixteenth century. The unknown interior, except for occasional Acadian hunting forays, was left to the rapidly diminishing, steadily retrograding Micmac Indians.

Increased British interest in the area, largely strategic rather than economic if the mixed interests of Britain's influential mercantilists can be separated, led to the establishment of the fortress port of Halifax in Chebucto Bay in 1749 and, shortly thereafter, other settlements in the coves of the rocky, intricately serrated, southern coast.[14] Then followed the great New England migration to the farthest "down east" as hundreds of fishermen and traders settled the sheltered coves and harbors of the southern and western coasts while thousands of inland farmers poured in to occupy the Fundy lands on the north from which the Acadians were largely deported in the fifties.[15] There were, too, migrations of Yorkshiremen to the Chignecto area, of Scotch-Irish to the head of Cobequid Bay, and of highland Scots to the northeast.[16] Then came the American Revolution which, while effectively stopping one kind of movement from New England, eventually brought to Nova Scotia from all the colonies a flood of Royalist refugees. In the eighties, this influx temporarily more than doubled a population of seventeen or eighteen thousand. The last immigrants were too late for the best lands, however, and antipathetic to the "neutral Yankees"[17] who had preceded them in such large numbers. In the end a large, if undetermined, proportion of them moved on, especially to the new Loyalist colonies of New Brunswick and Upper Canada. In the last decade of the century other groups came from Britain, but the New Englanders, the Loyalists and disbanded soldiers, and the Acadians who had evaded deportation (or filtered back after it) were the major elements in a population in which German, Ulster, Yorkshire, or Hebridean groups had local prominence.

We do not know with any precision the population of the peninsula[18] at the turn of the century. We may accept an estimate of 18,000 for the immediate pre-Loyalist period of the early eighties.[19] With a considerable net increment from the

[14] Notably Lunenburg where Protestant continentals of French and German speech, originally imported to dilute the catholicism of the Acadians of Minas Basin and Baie Verte (Chignecto), were settled for greater security against French-incited Indian attacks.

[15] The fact that the chief direction of movement of people in the northern colonies was to the north and east rather than west has been largely overlooked by American historians. J. B. Brebner's excellent studies, including especially *New England's Outpost* (New York, 1927) and *The Neutral Yankees of Nova Scotia* (New York, 1937) are outstanding exceptions.

[16] The "enclosure" and "high farming" programs widely in effect in the British Isles in the eighteenth century were dispossessing the poorest tenants in Scotland and making rents higher than many could afford throughout the British Isles.

[17] J. B. Brebner, *op. cit.*, in footnote 15.

[18] The colony of Nova Scotia in 1801–2 was confined to the peninsula. Prince Edward Island (St. John Island until 1798) had been attached to the Halifax government only temporarily and was long on its own. When New Brunswick was set up as a separate colony in 1784, Cape Breton was similarly treated, not to be reunited to Nova Scotia until 1820.

[19] J. B. Brebner, *op. cit.*, (1937) p. 95 discusses much of the various conflicting and unreliable evidence. After a check of most of Brebner's sources and some others the uncertainty holds at between 15,000 and 20,000 (including Cape Breton).

Loyalists and disbanded soldiers who came and stayed, from the steadily returning Acadians, from the trickle of new immigrants, but especially from the abundant natural increase of the established settlers, it seems safe to assume between 40,000 and 50,000 people whose probable distribution is roughly shown in Figure 1. Of these a good fifth lived in Halifax or its immediately suburban settlements. The rest were scattered widely, but almost all were very close to the periphery of the almost insular peninsula.

The great bulk of the interior, however widely it may have been traversed by land speculators, hunters and trappers, occasional official surveyors, or the rare adventurous farmer or timber-cutter, was really little known and what reputation it had was of conflicting and unreliable character. The economic life of Nova Scotia hung suspended, literally, between the sea and the forest. New settlers and new industries were needed, and for them new lands. Although the suspicion was strengthening that most of the interior was the rocky, lake-strewn wilderness we now know it to have been (and largely still to be) hope remained strong that large stretches of good land, and more certainly of good merchantable timber, might still be found. His Majesty's Governor and Council and the elective Assembly very urgently wanted reliable information on, and a good map of, the interior.[20]

When Titus Smith junior started out to get it for them he operated under such instructions as these:

> Your principal object . . . will be to visit the most unfrequented parts, particularly the banks and borders of the different rivers, lakes and swamps, and the richest uplands. . . . You will make your remarks on the soil, the situation of the lands, and the species, quality and size of the timbers; the quantity of each sort also, and the facility with which it can be removed to market . . . and in every place which you shall deem calculated for these purposes[21] you will, as near as possible, estimate the quantity of acres, the possibility and means of rendering them fit for cultivation, either by banks, drains, or otherwise.[22]

[20] On May 5, 1801, a committee of the Council (the appointed senior legislative and, under Lieutenant Governor Sir John Wentworth, also the executive body of the colony), appointed by the Governor to consider the matter of hemp culture in the colony, reported. The kernel of that report is contained in this excerpt: "Your committee deem it an object of great importance, that Government should be put in possession of facts, and no longer rely on vague reports which, on one hand, have often depressed the worth of this country below its real value;—whilst others, especially the French writers, have given flattering descriptions above the truth. To this end we recommend that a survey shall be taken, of a nature as extensive as the season, to the end of October, will admit, of those inland parts which have been least visited or are entirely unknown, with the view of discovering those spots which are best adapted to the growth of Hemp, and the furnishing of other naval stores . . .

"We also, flatter ourselves that much of the advantageous side of the character of Nova Scotia will prove to be well founded . . ." (Public Archives of Nova Scotia, 303, doc. 4.)

The choice of Smith may well have been due to the Governor's friendship with his father which had extended to the pre-Revolutionary period in New England, where Wentworth had been Governor of New Hampshire and Surveyor of His Majesty's Woods in North America, a sinecure he still held when he came to Nova Scotia. Wentworth, too, had been the donor of the Linnaeus volumes to the Smith library.

[21] I.e., hemp production in particular. The concern for hemp fitted the pattern of the imperial interest (or more usually disinterest) in Nova Scotia as a strategic naval base; truth

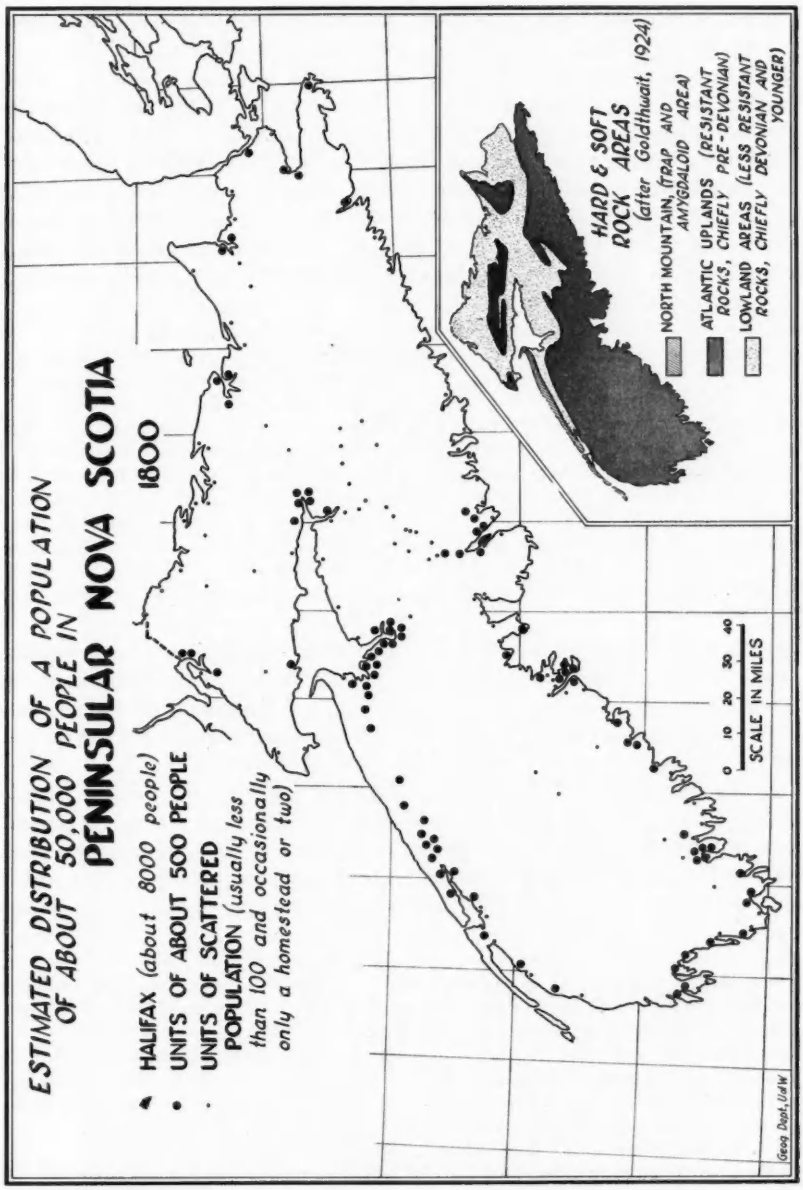
ESTIMATED DISTRIBUTION OF A POPULATION OF ABOUT 50,000 PEOPLE IN
PENINSULAR NOVA SCOTIA
1800
HALIFAX (about 8000 people)
UNITS OF ABOUT 500 PEOPLE
UNITS OF SCATTERED POPULATION (usually less than 100 and occasionally only a homestead or two)
HARD & SOFT ROCK AREAS
(after Goldthwait, 1924)
NORTH MOUNTAIN, (TRAP AND AMYGDALOID AREA)
ATLANTIC UPLANDS (RESISTANT ROCKS, CHIEFLY PRE-DEVONIAN)
LOWLAND AREAS (LESS RESISTANT ROCKS, CHIEFLY DEVONIAN AND YOUNGER)
0 10 20 30 40
SCALE IN MILES
Geog Dept, UofW

FIG. 1.

This was, in effect, to be a land-use and resource survey with no elaborate methodology or equipment, no air photos, not even a moderately good base map. We make a great thing of such surveys today; they are not by any means new—just easier. Smith spent more than 150 days actually in the woods (over 200 away from his base) in two field seasons (1801 and 1802) equipped with his brief, but formidable, instructions, a compass, a pencil and notebook, some sort of a map which was probably as much hindrance as help, and whatever he could wear and carry to maintain himself afoot for days at a time in some of the roughest going on the North American continent. He was no complainer or boaster, but one brief extract from his journal of one day in the eastern interior will illustrate the conditions under which he worked:

> As much as 8 days out of 12 that we have been in the woods have been cloudy or rainy. We have been for several days, obliged to travel when it rained the whole time; and we are much more liable to turn out of our course than when we have the sun to guide us; we have travelled many miles in black spruce thickets, where we were obliged to squeeze our way through the bushes, which were so thick, that we could seldom see two Rods ahead, and when [we had] set the Compass we could do little more than turn our faces the right way, and were then obliged to go constantly on a zig-zag line to avoid such places as were absolutely impassable. In some places we have been obliged to cross burnt barrens where the original growth of spruce had fallen within 3 feet of the ground, crossing each other every way, and a thick growth of young bushes had sprung up. In such places we could form but an indifferent judgment of the distance we travelled as we probably walked more than two miles to advance one. This may account for the shortness of some of our days' journies . . . but we never had more fatiguing days' journies than those in which we travelled the least distances.[23]

The results of these, the most careful and important explorations of the interior made to that time—or to be made for a long time to come—were submitted to the government in the form of journals, summaries, floral lists and descriptions, and some special notes on particular topics. They have never been printed in full and have been little known or used. Part of the reason is that both the accompanying map (Fig. 2), indicating the territory covered in each day's journey, and the longest part of the journal itself (that for the Western Tour including a section on general observations) were long lost or misplaced. Both have recently become available and the combination of written material and map give us a magnificent base on which to build a geography of the interior of the colony at the beginning of the nineteenth century.[24]

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to tell the Board of Trade which attempted to guide or control the colony with the fumbling fingers of its left hand saw little other reason for maintaining it. Even the interest in the fisheries was, to a degree, a naval interest once removed.

Nova Scotia had been producing hemp in minor quantities since the 1760's; a report of 1766 listed 932 lbs. (Francklin's census report for 1767 reprinted in Nova Scotia Historical Society, *Collections for 1889–91,* VII (1891). p. 56) and it appears in varying quantities in various other statistical compilations before the end of the century.

[22] Mrs. William Lawson, *op. cit.,* pp. 209–11.

[23] *Journal of the Eastern Tour,* May 24, 1801. All the quoted material is from copies of the Smith manuscripts in the Public Archives of Nova Scotia. It is hoped that possible errors in the copying and checking do not include any serious misreadings or omissions.

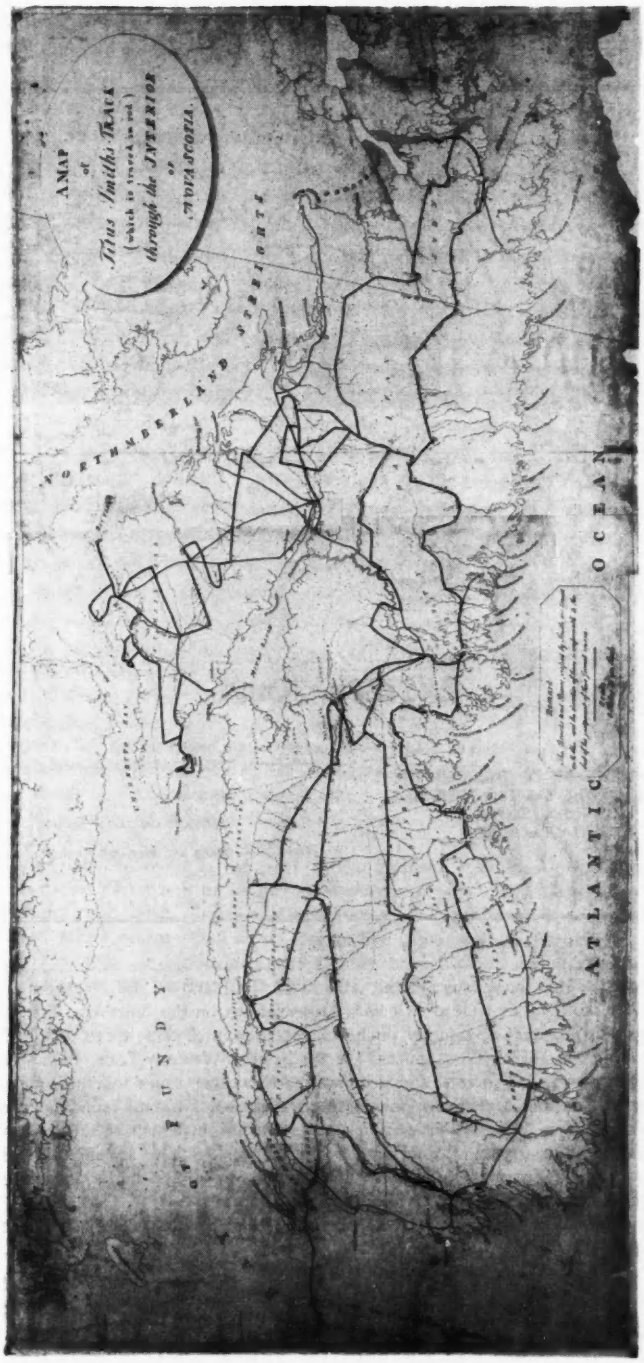

FIG. 2. The only cartographic record of Smith's journeys. Its date, authorship and reliability are all questionable.

The explorations were conducted in two successive years: those of 1801, which Smith called the *Eastern* and *Western Tours,* and that of 1802, the *Northern Tour.*

FIG. 3.

[24] The "Journals" of the Eastern Tour, May 5–17, 1801 and of the Northern Tour, September 2–October 16, 1892, as well as "General Observations on the Northern Tour" and some supplementary material, were apparently published together in at least three editions, the third appearing in Halifax in 1857. The "Journal" of the lengthy Western Tour, July 8–October 19, 1801, which greatly exceeded in time and distance the two other tours together, and the "General Observations" for that tour were long lost and Piers *op. cit.,* had found no clue to their nature or whereabouts in 1938. What purports to be the original map of the three tours (reproduced in photostat in Figure 2) had similarly disappeared. The absence of the map and the greatest part of the journal has hitherto discouraged use of the material, a situation this paper is designed to correct.

The map may well be the work of some one other than Smith. The base is decidedly in-

The first tour (Fig. 3)[25] started at Geddes Mill, an ephemeral name applied to the pioneer settlement on the upper Musquodoboit River, thirty five miles northeast of Halifax in a direct line.[26] Smith was accompanied on this trip, and later on the Western Tour, by a Mister Carter. At Geddes, a Colonel Robert Archibald, who had pushed this far south from the Scottish settlement at Pictou to live, was able to provide them with useful local information. From this they estimated that they were eight or ten miles nearer the sea coast than was shown on their map, the first indication of its general unreliability. From local experiments and their observations they concluded that hemp would do well along the upper valley of the Musquodoboit.

On May 12 they headed into the woods for the west branch of the St. Mary's River which they reached, well above their intended goal, on May 16. There were a good many patches of hardwood, but the country was mostly clothed in black spruce, with an over-generous sprinkling of bogs, lakes, and rivers.[27] The frequent comment that the good land, identified by its hardwood cover, tended to be on top of the ridges, an observation constantly repeated throughout the three tours, is of great importance in reconstructing the forest ecology of the time. All of Nova Scotia was heavily glaciated and the irregular stony ground moraine has seriously interrupted drainage so that conditions are generally like those of the Canadian shield. A difference is to be found in the presence of many drumlin fields in Nova Scotia, chiefly developed on the slates of the Precambrian formations. Although most of the known

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accurate at any distance inland from the coast and the failure of the map to jibe with the journals in a number of places has raised this doubt. It apparently remained the best map of the colony until 1834 when Wm. Mackay prepared and published his map under a special grant from the legislature (Piers, *op. cit.*, p. 12).

[25] The maps of the separate tours, given here as figures 3, 4, and 5, were made on an accurate modern base from the day to day entries in the journals, reference to the largest scale topographic sheets or vertical aerial photographs where available, the "Smith" manuscript map (figure 2), other maps of the period for contemporary names and terminology, and personal exploration of, or familiarity with, many of the areas. There remain a number of uncertainties; particular doubt attaches to the track of the Eastern Tour from June 5 to 9 and of the Western Tour from October 8 to 11, but there are many other days for which some degree of uncertainty must exist, when direction, distance or other description seem impossible to reconcile completely with present maps or air photos, or where such large scale modern maps or photos are unavailable. A particular problem attaches to Smith's stay in the Milford Sound—Canso Strait area on the Eastern Tour, as to whether he journeyed between them by land or sea, or both.

[26] The instructions, reprinted in Lawson, *op. cit.*, p. 210, had specified "You will, in the first instance, go to the eastward of this harbour to the spot from whence [sic] issue the heads of the Rivers Stewiacke, Musquodoboit and Saint Mary . . .". Despite the official orthography Smith's journals use variant spellings and names, notably the old "Souiac" rather than Stewiacke, for the major eastern tributary of the Shubenacadie River.

[27] After leaving the Musquodoboit valley, carved in Paleozoic limestones and shales rated as Upper Mississippian in age, the explorers remained on Precambrian slates and quartzites or Devonian granites (which form the surface rocks of most of southern and western Nova Scotia) until they reached the St. Mary's River.

drumlins are west of Halifax some of the rises, topped by hardwood, in the area south of West Branch St. Mary's River, may well have been drumlins. The area has been little explored, except by gold prospectors, since Smith's time.[28]

Because the low terraces and narrow freshet-flood plains of the rivers (lumped together in the common terminology of the northeast as intervals, or intervales) offered the chief agricultural promise, for hemp or anything else, a good deal of attention was paid to such land along the St. Mary's. Smith described it as discontinuous, in width from 20 to 40 rods (330 to 660 feet). He felt called upon to comment on two roughly square patches of from 40 to 50 acres as the largest seen. No settlers were seen which surprised and disappointed them, especially in the extensive, if often marshy, lowlands around the main fork of the St. Mary's, which they reached on May 21. The large maples, elms, oaks, and yellow birches were indicative of good land. The large number of Indian "camps" (wigwams) Smith interpreted as evidence of plenty of salmon in the river.

At this point they concluded that their base map showed, or attempted to show, the true points of the compass. They then headed for Manchester settlement on Milford Haven (now Guysborough River) at the head of Chedabucto Bay, which they reached on the 24th. On this leg of the journey Smith was impressed with the amount of limestone, the frequently rocky nature of the surface, but nevertheless the generally better quality of the land than that south of the St. Mary's River. They were, of course, here on softer, geologically younger rocks.

The period from May 24 to June 1 was spent in the general area of Milford Haven and the Gut (Strait) of Canso. Although the map indicates a return trip by land between the two, the journal makes it seem likely that it was made by sea. Here are some of Smith's comments:

> There are a number of fine farms along the sides of Milford Haven which show great marks of Industry. The interval upon which the brook runs in at the head of Milford Haven is settled for about 4 miles above the salt water. It produces very fine crops of English Hay which I was assured by some of the Inhabitants suffered nothing from the uncommon drought last summer but they complain of having their Indian Corn and Potatoes frequently cut off by frosts in the month of August. I have observed that this interval lies between two very high hills of good land, the tops of which I think, from all I ever observed, as well as from information received . . . would be perfectly secure against such early frosts . . . Along the Gut of Canseau [sic] . . . there are no great improvements . . . as the inhabitants spend great part of their time fishing . . .[29]

On June 2 they left the upper interval of Milford Haven and headed west and north until, on the morning of June 7 they reached a "road" from Anitgonish to Pictou which looped south on higher ground. The area, now the back-country of Guysborough and Antigonish counties, probably had no settlers at the time. The "road" was presumably a blazed foot-track as, also presumably, were most of the other "roads" shown on Smith's map and reproduced in Figures 3, 4, and 5. It is

[28] J. W. Goldthwait, *Physiography of Nova Scotia,* Canada Department of Mines, Geological Memoir No. 140 (Ottawa, 1924) although out of date in particulars in some areas, is still the basic source on the Pleistocene geology of the province.

[29] *Journal, Eastern Tour,* May 27, 1801.

doubtful if wheeled vehicles could travel for any great distance beyond the immediate settlements at the time, with the probable exception of the Halifax-Windsor road and the possible one of the Windsor (i.e. Falmouth)- Annapolis road, or considerable parts thereof. Again the dominant theme of the stretch between Milford Sound and Pictou was the patchiness of softwood and hardwood, and the disappointingly rocky nature of much of the land which bore the latter and was, as before, higher than the softwood land. Perhaps of most interest was the dominance of fir and the scarcity of spruce and pine in the coniferous belts and patches.

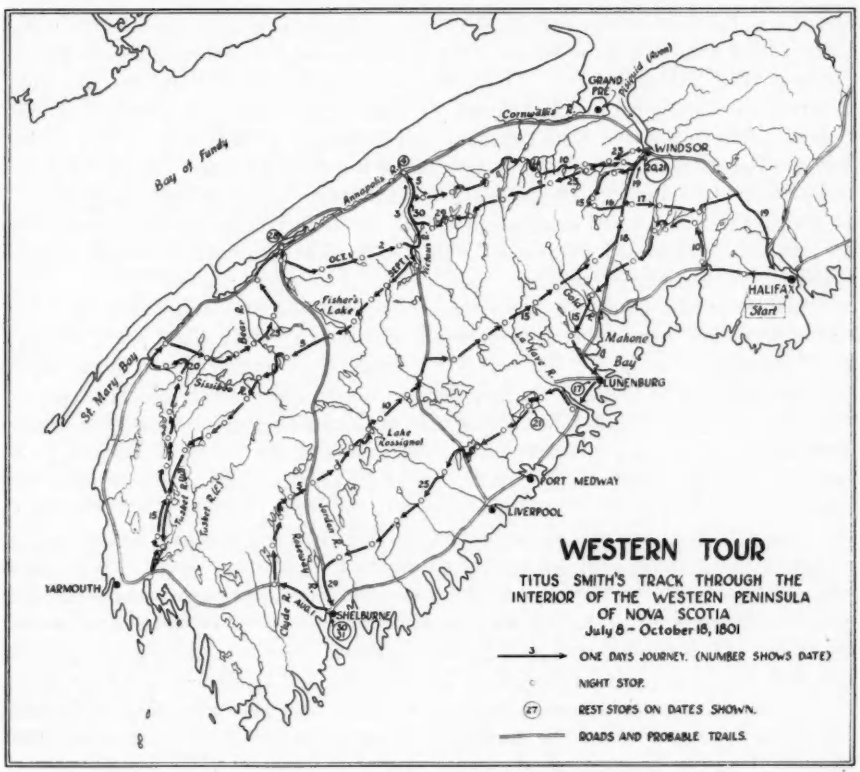

FIG. 4.

After getting supplies at Pictou on June 8 they headed south and a bit east for the upper Souiac (Stewiacke) and so back to their starting point on the upper Musquodoboit on June 11. After a day of recuperation and writing they spent another five days in exploring the land between the headwaters of Ship Harbour and the middle course of the Musquodoboit and headed back to Halifax on the 17th, presumably following blazed tracks or "roads" through the bush from the river to Dartmouth. Here the comments include emphasis on the large amount of burnt-over

land, a constantly recurring observation on the Eastern and Western Tours, and on the dominance of poplar-sprinkled coniferous forests near the Musquodoboit. In his conclusion Smith averred that the land north of St. Mary's River and Milford Sound might be largely fit for cultivation as a good deal of it, indeed, turned out to be.

On July 8, again accompanied by Carter, Smith began the longest of the three tours which was not to end until October 19 (Fig. 4). It involved what amounted to four line traverses paralleling the axis of the peninsula west of the road between Halifax harbour and the Avon estuary. Perhaps the outstanding feature of this long account is Smith's impression of monotony in the countryside. This was, and still is, the least known part of Nova Scotia, almost equally divided between the great glacier-scoured granite bosses of the Devonian and the variously resistant Precambrian quartzites and slates. Today the only significant agricultural developments at any great distance from the coasts are those in the interior of Lunenburg and Queens counties between New Germany and Caledonia (which were in fact under way in 1801 as Smith later observed). All of the others, in tiny patches of dubiously fertile land throughout this vast "moose farm" are relatively insignificant. Doubtless Smith suspected what he might find, but neither he nor anybody else knew for sure and he planned his traverses so that no possible farming area of any considerable extent might be overlooked.

Now the hardwood patches were more infrequent, and even under such cover on top of occasional rises (often drumlins which of course Smith could not identify), the soil was none too good. On July 16 the explorers, who had looped to the north from the head of St. Margaret's Bay, headed out to the coast at the Mushamush (Mahone Bay) settlement, followed the road to Lunenburg, and, on the 18th, southwest to La Haive [sic] settlment on the right bank of the La Have estuary. On the 19th they made their way some ten miles to a sawmill, southwest of the site of the future town of Bridgewater and on a branch of the Petit Riviere [sic]. Having a bad time with the maze of lakes in southwestern Lunenburg county[30] and illness, it was the evening of the 23rd before they struck the Port Medway River. Smith was well impressed with the timber and the water and very poorly with the soil. On July 25 they were forced to raft over the Liverpool River. The same monotonous sequence of lake, swamp, rock, and spruce continued until, after rafting once more, this time over the Jordan River, they joined a track to Annapolis, 13 miles from Shelburne and presumably on the left bank of the (Port) Roseway River. Toward Shelburne he comments on the sandiness of the soil although they were told that manured land had produced good crops.

Proceeding west from the sprawling remnants of that short-lived Loyalist metropolis[31] on August 1 they spent the night at a small farm on the Cape Negro (Clyde) River where they were assured by the settler that they

> should not find a Foot of good Land between his House & Argyle.[32]

[30] The difficulties were vicariously shared by the writer in trying to trace their route from July 20 through July 22.

[31] Shelbourne, quickly drifting toward the status of a ghost town in 1801 (a status it maintained for much of the 19th century), had been, in the 1780's, the chief focus of Loyalist emi-

This determined them to head north and east once more. Although the farm was twelve miles from the nearest other inhabitant, and the soil naturally not fertile, Smith thought it had the best crops in the Shelburne area.

With the turn north the monotony returned:

> Land 2/3 Spruce Swamps and low Spruce Barrens—the Remainder Rocky Hills covered with Hemlock, Spruce and pine.—N.B. the first Hemlock we had seen since we were a Mile this side of Liverpool River[33]

is a typical entry. Although there were occasional hills covered with white birch, oak, and poplar there was little true hardwood country south of Lake Rossignol. Again the burnt-over lands were extensive. On August 8 they came to the largest lake they had seen which they correctly assumed to be Lake Rossignol.[34] They rafted along it for some miles to avoid the deeply indented coastline and spent a night on an island in the lake:

> We have seen about 150 Acres of good wild Meadow on the River [Shelburne] and Lake, perhaps 300 of poor which might be worth mowing; there may be more back but that which lies off the lake is chiefly bad.[35]

East of the lake there were more hemlock hills.[36] On the 11th they reached the track from Liverpool to the Annapolis valley and, further on, found a settler where the track approached the Port Medway River. Here the land improved with some real hardwood cover (yellow birch, beech, soft and hard maple, oak, and hornbeam). On August 12 they pushed on eastward to the Pleasant River settlement, just begun by some young men. The territory traversed from the 11th to the 15th was chiefly on Precambrian slates, to which Smith frequently calls attention, and from the drift above which the moderately extensive agricultural soils of this area are known to be developed. Again there is no indication that he recognized the distinctive shape of any of the drumlins he must have seen. He does comment that the eastern side

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gration and for a brief time, with a population of over 10,000, had exceeded in size not only Halifax, but perhaps any contemporary urban center in British North America. Even the Lunenburgers, whose agricultural achievement on the Precambrian rocks of the Atlantic slope is one of the brightest pages in North American agricultural history, could have done little on the granite or quartzite based, sandy drift soils of the Shelburne area, or at any rate not ten thousand of them. In any event the aristocratic Tories, plantation owners, merchants, professional men, and officials (largely city folk) who crowded into Shelburne as refugees deluxe, were a far cry from the Swiss, Montbeliard, and Palatine peasants who had settled a hundred miles nearer Halifax thirty years earlier as material for agricultural settlers.

[32] *Journal, Western Tour,* August 1, 1801.

[33] *Ibid.,* August 3, 1801.

[34] Then, and until quite recently, very much smaller than its present greatly enlarged area as it now serves as a dammed reservoir for one of Nova Scotia's largest hydro-electric power developments.

[35] *Journal, Western Tour,* August 8, 1801.

[36] Hemlock is today important to the lumbering industry of Nova Scotia, and Lake Rossignol is in one of the regions of greatest contemporary exploitation. Despite this attack the only known patch of undisturbed "primeval" forest in Nova Scotia was being investigated by botanists in the area when the writer visited it in 1948.

of each hill they passed had the best land. Where the pair crossed the La Have River on the 14th there were only some twenty rods of interval between the slate hills which marked the borders of the valley. On August 16, south of Sherbrooke Lake they came on the granite again and stayed on it until they came to the Chester-Windsor track on the 18th and followed it into Windsor.

After a two-day rest in Windsor they headed west into the bush again from north of Falmouth on August 22 and followed a roughly straight line until the 30th when, reaching the Liverpool-Annapolis valley track, they headed out to the valley for supplies at what is now Middleton, at the junction of the Nictaux (which the track followed south) and Annapolis Rivers. Not until they had come close to the Nictaux had they seen any hardwood and then it appeared only in small patches. From the 22nd to the 27th they had seen no "Old Growth [i.e. undisturbed forest] . . . a few Trees excepted."[37] Perhaps the most exciting discovery (and a testimony to the efficiency of two hundred years of the fur trade) was "the first inhabited Beaver house we have met with West of Halifax."[38]

Leaving the Liverpool track again on September 1, somewhat south of where they had reached it on August 30, they headed southwest to the upper Tusket drainage, reaching "civilization" again at Tusket Falls on the 12th. Only in the last stretch of this journey, when they finally got off the granite, did they strike more land with any agricultural promise. Visiting the tidewater settlement down the river Smith was impressed with the poverty of the soil. Moreover

> there is a French Village below here where the People live entirely upon Eels & Potatoes. One of the most able of them assured me that most of the French Families did not use 4 Pounds of Flour in a year. They keep Sheep enough to make their own Clothing, & the Meat and Butter which they sell supplies them with the little money they need.[39]

The period of September 14–20 was spent in a traverse through the maze of lakes and streams in the West Tusket valley and on north to the lower Sissiboo River where they again went out to the settlements.[40] On this stretch Smith comments on plentiful evidence of bear, moose, and caribou. From the 22nd to the 27th they started another wide arc into the bush coming out again at the settlement of Clements[41] whence they followed the road to Annapolis and stayed over two nights. Heading southeast from Annapolis they continued until on October 3 they struck

[37] *Journal, Western Tour,* August 27, 1801. Presumably Smith implies that the area had been subjected to repeated burning. The Annapolis Valley settlers, whether Acadians or their New England successors, could scarcely have cut and removed any substantial amount from this area and they would have had no occasion to come in so far from the settlements.

[38] *Journal, Western Tour,* August 28, 1801.

[39] *Ibid.,* September 13. The Acadians had made many small fishing settlements on the south and west coasts in addition to their principal lands on the shores of the Fundy inlets. To these, or nearby coves if New Englanders had beaten them to their old locations, they returned from the woods, or overseas exile, in a small but steady trickle from 1761 on.

[40] The beginning of the Weymouth settlement.

[41] Probably through the present Clementsvale settlement and four miles down Moose River to present Clementsport.

the Liverpool-Nictaux track somewhat north of where they had left it on September 1. Out to the settlements again for supplies they heard of

> an Indian here who has been at Work this Season and raised a small Crop of Corn, Wheat & Potatoes, and who is very desirous of continuing to work at farming, but his Countrymen have taken as much Pains to divert him from the miserable Kind of Life which they fancy he must lead, as white Men could have done to prevent one of their Friends from living with the Indians. His Squaw was always uneasy and finally ran away from him into the Woods . . . most probably his Countrymen will finally persuade him to quit his new Occupation, as he will be accounted an Indian by white Men, and if he follows farming, will be looked upon as a white Man by Indians.[42]

On the 5th they went south on the track again for 8 miles (the fourth time they had traversed this particular stretch of it) and headed east on a line which cut their former traverse and so into Windsor again on October 12. On the 13th they started their last swing into the woods, again in an arc which cut back to and across the Windsor-Chester track on the 16th, to the Windsor-Halifax road on the 19th, and so home to Halifax.

In his *General Observations on the Western Tour* we learn a great deal about the western peninsula as it was a century and a half ago inland from the settlements. The large area of swamps especially concerned Smith and he elaborates on various plans for draining them. A useful suggestion of the possible superiority of winter to summer for travel is given in a discussion of roads:

> The large tract of spruce land, which lies above the Head of [St.] Margaret's Bay, is so mountainous and Rocky that it must be extremely difficult to make any carriage road through it, but I do not think there would be much difficulty, in making winter roads as there are a great number of lakes on the streams which run through it.[43]

There is some propaganda in favor of agriculture, how objective in view of Smith's known prejudices, may be open to question:

> In every part of the province where we have been [i.e. presumably on both the Eastern and Western Tours] we generally found those who followed fishing complaining of poverty and a hard country; whilst those who depend entirely on farming generally hold an opposite language and appear well satisfied with their situations, and sensible that they are in a thriving condition.

He goes into considerable detail as to possible areas of farming land, the largest area being that in the Caledonia-New Germany district where, in his judgement, 268 farms of 100 acres each could be established.[44]

The floral lists accompanying the 1801 report contained descriptions of the trees listed in table I, with details of their ecology and utility. Smith's acute eyes picked

[42] *Journal, Western Tour,* October 3, 1801. The same account, with some elaboration, is repeated in the concluding "General Observations on the Western Tour."

[43] These excerpts are from the section of the manuscript with the title indicated.

[44] The 1861 *Census Report* of Nova Scotia listed "acres occupied" in the four polling districts of Brookfield, Caledonia, Greenfield (all in Queen's County), and New Germany (in Lunenburg County) as 23,896—a remarkably close approximation to Smith's prophecy. At the same time it should be said that his estimate of good land for 300 farms in the Tusket drainage area was more than optimistic.

TABLE I

TREES OF NOVA SCOTIA, 1801–2, FROM THE TITUS SMITH MANUSCRIPTS

Name given by Smith	Identification by Smith in Linnaeus' "System Naturae"	Presumed equivalent*	Contemporary taxonomic designation*
1. Larch, Hackmetac, or Juniper	*Pinus Larix*	Tamarack, Larch, Hackmatack or "Juniper"	*Larix laricina*
2. White Pine	*Pinus Strobus*	White Pine	*Pinus strobus*
3. Yellow Pine	*Pinus Silvestria*	Red Pine ?	*Pinus resinosa ?*
4. Mountain Pine	*Pinus Pinea*	Jack Pine ?	*Pinus banksiana?*
5. White Spruce	*Pinus*	White, Pasture, or Cat Spruce	*Picea glauca*
6. Black Spruce	*Pinus*	Black or Bog Spruce	*Picea mariana*
7. Red Spruce	*Pinus*	Red Spruce	*Picea rubens*
8. Balsam Tar	*Pinus Balsamifera*	Balsam Fir	*Abies balsamea*
9. Hemlock	*Pinus*	Hemlock	*Tsuga canadensis*
10. White cedar	*Thaya Occidentala*	White Cedar	*Thuja occidentalis*
11. Trembling Poplar**	*Populus tremula*	Trembling Aspen	*Populus tremuloides*
12. White Poplar**	*Populus Alba*	Poplar	*P. grandidentata*
13. Black or Yellow Birch	*Bitula Nigra*	Yellow Birch	*Betula lutea*
14. White Birch	*Bitula Alba*	White, Paper, or Canoe Birch	*B. papyrifera*
		or	
		Wire or Gray Birch	*B. populifolia*
15. Dwarf Birch	*Bitula Nana*	Uncertain, perhaps a variety or early stage of White or Gray Birch	*B. pumila?* or *B. michauxii?*
16. Beech	*Fagus Silvatica*	Beech	*Fagus grandifolia*
17. Oak	*Quercus Rubra*	Red Oak	*Quercus borealis*
18. Elm	*Ulmus Americana*	Elm	*Ulmus americana*
19. White Ash	*Fraxinus Americana*	White Ash	*Fraxinus americana*
20. Black Ash	*Fraxinus*	Black Ash	*Fraxinus nigra*
21. Sugar, Rock, Curled or Birdseye Maple	*Acer Saccharinum*	Sugar Maple	*Acer saccharum*
22. Red, Flowering, White or Soft Maple	*Acer Rubrum*	Red or Swamp Maple	*A. rubrum*
23. Moosewood maple	*Acer*	Either*** Striped Maple or Mountain Maple	*A. pennsylvanicum* or *A. spicatum Lam.*

TABLE I (continued)

TREES OF NOVA SCOTIA, 1801–2, FROM THE TITUS SMITH MANUSCRIPTS

Name given by Smith	Identification by Smith in Linnaeus' "System Naturae"	Presumed equivalent*	Contemporary taxonomic designation*
24. Dwarf Maple	*Acer Mana*	Either**** Striped Maple or Mountain Maple	*A. pennsylvanicum* or *A. spicatum Lam.*
25. Mountain Ash or Fowler's Service	*Sorbus Aucuparia*	Mountain Ash and possibly Chokeberry	*Sorbus americana* *Aronia prunifolia*
26. Hornbeam	*Carpinus Ostria*	Hop Hornbeam	*Ostrya virginiana*
27. Black or Pigeon Cherry	*Prunus*	Wild Black Cherry	*Prunus serotina*
28. Red cherry	*Prunus Avisim*	Bird or Pin Cherry	*P. pennsylvanica*
29. Choak Cherry	*Prunus Virginica*	Choke Cherry	*P. virginiana*
30. Wild or Indian Pear	*Mespilus*	Shadbush, Wild Pear or Bilberry?*****	*Amelanchier* spp.

* A. E. Roland, *The Flora of Nova Scotia*, Truro, n.d. (reprinted from *Proceedings of the Nova Scotia Institute*, vol. 21, Part 3, 1944–5) was used with Smith's more detailed descriptions to make these identifications.

** Smith was doubtful of two species of poplar; what he describes may be either or both.

*** Probably the former.

**** Probably the latter.

***** This seems to be the only possibility. Some *A.* species have leaves similar to the European medlar which, apparently, was in Smith's mind.

out most of the thirty-three species of forest trees now considered to be native to the peninsula. In addition to those in the table, all but one of which are reasonably identifiable at least within a genus, he listed the alder (*Alnus crispa* var. *mollis* or *A. rugosa* esp. *var. americana*), the balsam poplar (*Populus balsamifera*) and hawthorn (*Crataegus* spp.), just about completing the catalogue if the three willows listed, no doubt properly, with the shrubs, should be included. In all, it constituted a remarkable achievement. His listing of sycamores (*Platanus* spp.) and limes (*Tilia* spp.) is puzzling. Admitting that one or both of these exotics might have become established in the settlements for many years it seems unlikely that either could have appeared in such circumstances, in competition with native wild flora, that it could have been mistaken for such. Finally he listed a foxberry tree; his meaning here is obscure since the only present Nova Scotian use of the term is for a creeping shrub (*Vaccinum Vitis-Idaea*) of the blueberry-cranberry genus. A rather wild guess is that he might have meant a buckthorn, either the exotic common, or native alder-leaved species.

Apart from trees he lists some fifty shrubs including the three willows; twenty species of grasses, sedges, and rushes; twenty other species in a catchall category; and approximately a hundred kinds of medicinal plants.

Smith's affairs kept him in Halifax until September 1802 when, this time alone, he set out on his Northern Tour (Fig. 5.). This was over country which contrasted

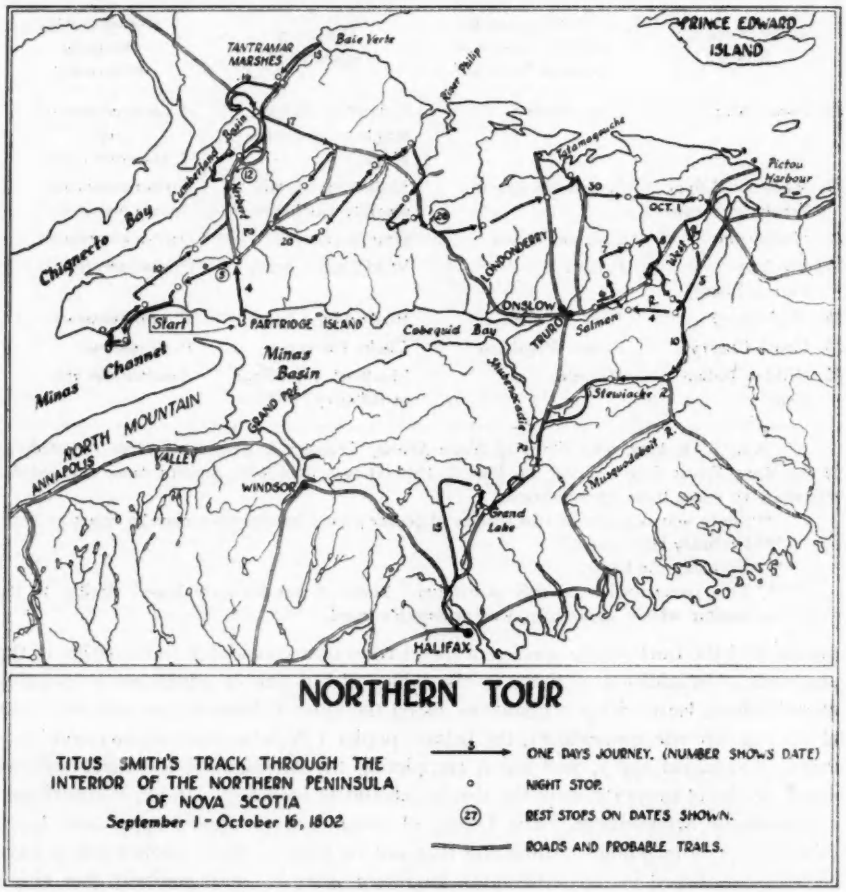

FIG. 5.

strongly with that of the Western Tour: Cobequid Mountain, tidal flats of Cumberland Basin, and the Gulf slope between the mountain and the Straits of Northumberland, for the most part. He saw more settlers and farms, or potential farming country, and much less lake and swamp, but there were still many heavily forested areas which were surprisingly poorly known to official Halifax.

He left Halifax on September 2 and spent the last part of that day and most of the next waiting for the subsidized ferry which ran between Windsor and Partridge

Island.[45] From there he set out on a trip of several days exploring the Cape D'Or peninsula between Minas Channel and Chignecto Bay, ending at the settlement of River Hebert on the 11th. He attributed the oddly shaped copper ingots occasionally found at Cape D'Or (the presence of which had given the Cape and Minas Basin their names) to some kind of "volcanic fire," but could not forbear further speculation

> I have in the course of my tour, since leaving Cape Doré [sic] found reason to think that there is coal almost everywhere in the North Eastern part of the Province, which very often [is] accompanied by a Pyrite composed of sulphur and iron . . . [so] I think it not very extravagant to suppose that a large body of these two inflammable substances (coal and Sulphur ore) taking fire may have melted a body of Rock which contained veins of Copper ore and have produced the present appearances at Cape Doré.[46]

The export of grindstones was proving a valuable supplement to that of gypsum in the American trade and at Joggins, west of River Hebert on the shore of Cumberland Basin, he observed:

> The bank here, for a number of miles, is a rock of freestone, of various kinds, much of which is suitable for Grindstones, of which a great number are made here. The grindstone rock varies in hardness, color, and fineness of grain, it is usually grey, light-blue, or reddish brown, it lies in layers about 8 feet thick and is naturally split into Laminae from about one foot to 3 inches in thickness.[47]

From the 14th through the 16th he made a tour about the Chignecto lowland including a crossing to Baie Verte. His journal entry for the 16th is a most detailed discussion of the hydrography of the peninsula in relation to the proposed Chignecto canal, and the tidal ranges at its two sides.

> I learn from Mr. Botsford that the highest customary spring tides, are, at Cape Chignecto 115 feet . . . at the head of Cumberland Bay [Basin] 55 feet; at Bay Verte from 8 to 10 feet. A strong S.W. will sometimes make the spring tides at Cumberland 5 or 6 feet higher than usual. The usual tides . . . are . . . at Cumberland 45 feet and at Bay Verte 6 feet. The tides at Bay Verte are about 3 hours earlier than at Cumberland, they are much more irregular . . . Mr. Botsford supposes the half tide at Cumberland to be nearly upon a level with that of Bay Verte; he thinks the consequence of opening a communication between them would be to lower the tides and lessen the current in the Bay of Fundy [!][48]

He continues this long entry:

> Notwithstanding the length of time that this part of the Province has been settled, I think that it contains but a small part of the inhabitants which it is capable of supporting. A great proportion of the marsh is still undrained, and does not produce anything near what it would if it were in good order, as the owners possess such tracts that they have not

[45] Just below present Parrsboro. The road thence toward River Hebert, which Smith followed for some ten miles, is today the approximate route of a part of Provincial Highway No. 2 between Amherst, Truro, and Halifax.

[46] *Journal, Northern Tour,* September 8, 1802.

[47] *Ibid.,* September 13. Nearly half a century later the supply of grindstone rock was still sufficient to make grindstones tenth in value in the list of provincial exports and second only to coal among minerals (having passed gypsum). (A. Gesner, *The Industrial Resources of Nova Scotia.* Halifax, 1849.)

[48] *Journal, Northern Tour,* September 16, 1802.

> been able to pay a proper attention to them . . . They are now raising a subscription for the purpose of making a direct road from Fort Lawrence to Fort Cumberland, as the present road is very circuitous; to effect this they intend to make a new Abatdeau [aboiteau] about 2 miles below where the present road crosses the Missiguash [sic], which besides materially shortening the road will save the expense of supporting a dyke, on each side of the River for 2 miles.[49]

From the isthmus Smith then made a big loop to the south and east and back north to the River Philip at the crossing of the "road" from Chignecto to Truro, near the present Oxford, between September 17 and 22. He found the settlers along the River Philip producing large crops and commented at length on the salt springs along the bank of the river between the road crossing and its mouth. Then followed another swing south to the mountain, back northeast to Tatamagouche, and through to the East River of Pictou between September 23 and October 2. On September 26 he stopped a night with a settler at the foot of the mountain where the main trail to the southeast began its winding path over the ridge. From Pictou he made a loop into the triangle between Pictou, Truro and Tatamagouche and then on to the Souiac (Stewiacke) settlement which he and Carter had bypassed on the Eastern Tour. Of this settlement he reported

> The interval on this River has a considerable mixture of sand in the soil and would probably answer well for Hemp. Twenty bushels of Wheat to the Acre is accounted a very good crop, although it sometimes yields nearly thirty.[50]

Thence he moved to strike the Truro-Halifax trail where St. Andrew's creek enters the Shubenacadie River. He comments that the interval of the latter, which was becoming settled rapidly

> is more suitable for grass than for arable land, it is very often flowed, owing to the tides which rise several feet for many miles above where the salt water reaches.[51]

He also comments on the need for a bridge where he had to build rafts to cross the river although "it is inhabited on both sides, and is not fordable."[52] After an excursion to the north and west of Grand Lake he then followed the Nine-Mile River trail south to Beaver Bank, to the Halifax-Windsor road, and so home once more to Halifax.

In his *General Observations on the Northern Tour*[53] Smith makes it clear that he judged the Cobequid Mountain (presumably from the Partridge Island-River Hebert road to the East River of Pictou) to have a fairly continuous hardwood cover whereas on the lowland between the mountain and the Gulf

[49] *Ibid.* The Cumberland-Sackville area had suffered a severe storm in 1759, with high winds at the highest tide, after the Acadians had been deported and before the first New Englanders arrived, and the degree and standards of Acadian utilization of the marshes had never been fully restored. The "aboiteau" is the valve-like swing-gate where streams cross the dykes, which closes with the incoming tide to shut out the salt water.

[50] *Journal, Northern Tour,* October 11, 1802.

[51] *Ibid.,* October 13.

[52] *Ibid.*

[53] The quotations which follow are from the part of the manuscript so titled.

> Considerable tracts of this land are very barren covered with a growth of small spruce. Many small pieces are covered chiefly with Beech, Birch and Maple and are good; but as much as half of this land is covered with a growth of Spruce, fir, White birch and poplar mixed.

Further

> It appears that it is only in the Eastern and North Eastern parts of the province that any considerable tracts of land can be found suitable for the Culture of hemp . . .

He goes on to touch on the problem created by the fact that so many of the immigrants were new to farming of any kind, a perpetual problem in the settlement of overseas lands from the British Isles in particular:

> Many of our new settlers were originally Tradesmen, and most of those who were farmers had been accustomed to land which required a different mode of cultivation so that they are often necessarily somewhat awkward at their business. It is generally customary here in clearing new land to fall the trees every way as they happen to lean, the branches are cut off, and the body of the tree cut into lengths of about 12 feet; the bushes and Logs are then made into piles and burnt. By the following method, which is at present much practised in the States of America, land is cleared with much less labour, and is in much better order for a Crop. The Trees should be all girdled by cutting out a single chip all round the tree, so as to cut through the bark or (which is a better method), have the bark stripped off for two or three feet in length, at the season when it parts easily from the tree. The trees are left in this condition for 5 or 6 years, by which time the small roots are nearly rotten; the branches of the trees decayed and the bodies of the trees are partly rotten below where they are girdled, so they can be felled with very little labour. The underwood is then either cut or grubbed up and piled in heaps, after which the trees are cut down, care being taken to fall them parallel to each other. The branches break to pieces in falling the trees, and require very little chopping . . .
>
> The beaver are almost all destroyed, although there is perhaps no country where they have been more numerous heretofore than in the barren part of this province, as appears from the remains of their old houses, canals, etc., which are to be found upon almost every one of the innumerable small lakes in the Rocky part of the Province. I have not seen more than half a dozen inhabited Beaver houses in the whole course of my tour. The consequence of this scarcity of game is that the internal parts of the Province are but little frequented by the Indians in the Winter. In the summer they take considerable quantities of Salmon, Gasperaus [sic] and Eels, in the different Rivers they frequent. I think a considerable number of them have left the Province . . .

These excerpts and descriptions must suffice until such time as the complete manuscript can be edited and published. Titus Smith lived for another half century to become an honored and respected figure in the colony, to give evidence before Lord Durham's famous commission at Quebec in 1838, to be Secretary of the General Board of Agriculture, to write a weekly column on agriculture for the *Acadian Recorder* for many years, and to lecture and publish papers on a wide variety of subjects. For example only, he became an authority on the fish, fisheries, and commerce in fish of the colony. Only one of his publications will be mentioned here, but it is, I think, of particular interest. It appeared in *The Magazine of Natural History, of London,* for July, 1835,[54] entitled:

[54] VIII: 641-662.

Conclusions on the Results on the Vegetation of Nova Scotia, and on Vegetation in general and on Man in general, of certain Natural and Artificial Causes deemed to actuate and effect them.

The article ended with a plan for the improvement and extension of agriculture in a world suffering from the over-production of manufactures.[55]

Geographers, like golden nuggets, are where you find them and Titus Smith, junior, of Nova Scotia by this evidence, was a most distinguished, if involuntary and unwitting, member of the profession. Observers of his quality are eminently worth the search of historical geographers; through their eyes, as in no other way, may we hope to see the lands we study, as nearly as may be, as they really were.

Accepted October 1953

[55] Since this manuscript was written the author has received a *ms.* by Eville Gorham of University College, London, entitled "Titus Smith, Pioneer of Plant Ecology in North America" which is to be published in *Ecology* for January, 1955. It elaborates on Smith's role as an ecologist and plant geographer.

THE MARKET AS A FACTOR IN THE LOCALIZATION OF INDUSTRY IN THE UNITED STATES*

CHAUNCY D. HARRIS
University of Chicago

MANUFACTURING in the United States is highly localized as a result of a complex of many factors. In the Manufacturing Belt of the Northeastern United States, which occupies only a twelfth of the country, is concentrated half the entire national market, seventy per cent of the industrial labor force, and the sources of supply of most materials and parts directly used in manufacturing. It should be made clear at the outset that the existence of this historically evolved belt, with its markets, labor force, factories, mines, transportation, and other established facilities, is far more important than the distribution of any particular raw material (such as iron ore) or of fuel (such as coal or petroleum), or of any other single factor such as labor or markets. The interrelationship between growth of this and other manufacturing areas and location of markets has been reciprocal; manufacturing has developed partly in areas or regions of largest markets and in turn the size of these markets has been augmented and other favorable conditions have been developed by the very growth of this industry. It is good to focus attention on man, as the active agent who develops tools, cultures, and technologies to satisfy his wants from whatever natural resources he can find and be able technically or economically to utilize. A coalfield is useless until it falls within the technological capabilities of specific human groups and until it can be utilized in a favorable economic environment. Geographers can learn much from economists with their emphasis on wants and markets and their flexibility in considering alternative resources that can be substituted for one another in the satisfaction of human needs.

Individual industries vary, of course, in their locational requirements both in respect to processing costs and to transfer (transport) costs.[1] The location of some factories is strongly affected by regional differences in processing costs, either of labor (cotton textiles) or of power (aluminum reduction). In order to minimize total transport costs other factories are best located between sources of raw materials

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[1] Edgar M. Hoover, *The Location of Economic Activity*. New York, 1948. Especially Part One, "Locational Preferences and Patterns," pp. 27–141; Richard Hartshorne, "Location as a Factor in Geography," *Annals of the Association of American Geographers*, XVII (1927): 92–99; Robert S. Platt, "A Classification of Manufactures, Exemplified by Porto Rican Industries," *Annals of the Association of American Geographers*, XVII (1927): 79–91; and H. H. McCarty, "Manufacturing Trends in Iowa," *Iowa Studies in Business*, VIII (July 1930): 1–79.

and markets. Factories that sharply reduce either the bulk or perishability of the materials in processing minimize total costs by locating near the source of raw materials; such are ore concentrating plants, sugar beet factories, creameries, cheese factories, sawmills, and canneries. These factories constitute only a small and decreasing fraction of manufacturing. Factories greatly increasing either the bulk or perishability of products locate near *local* markets: bread bakeries, ice cream factories, ice works, gas works, bottling plants for soft drinks, building construction, newspaper printing. Such industries, though large in total volume, are ubiquitous and do not contribute substantially to regional differentiation.

A large and very significant fraction of manufacturing in the United States is not tied to local raw materials, local markets, or to current regional differences in power or labor costs; this segment, typified by the automobile and agricultural machinery industries, appears to be concentrated in areas having maximum accessibility to national or regional markets for such products. These markets typically are associated with a considerable industrial labor force, with numerous other factories, and with well-developed facilities of many kinds. It is with such markets and associated phenomena that this paper is concerned.

The following questions seem pertinent to an analysis of the rôle of regional and national markets. Is the importance of the market as a location factor generally increasing or decreasing? Where are the markets? How can accessibility to them be measured? What are their divisions in terms of regions or of specialized activities such as mining, agriculture, or manufacturing? Does recent industrial growth indicate any attraction to markets and their associated phenomena? Such questions might be posed about any area or about the entire world, but the United States has been selected for investigation here. It embodies a widespread and very large market characterized by relatively homogeneous cultural and economic conditions, by a dense and interconnected transport network, by considerable national distribution, and by the absence of major internal trade barriers. Furthermore, comparable statistical materials are available.

IMPORTANCE OF THE MARKET

Economic activities tied to the location of raw materials are waning in relative importance; activities carried on near markets or in intermediate positions are surging upward. In contrast to falling employment in raw-material-oriented primary activities, employment in secondary and tertiary activities is rising rapidly. Primary, secondary, and tertiary as here used refer broadly to the production of raw materials, to the processing of materials, and to the performance of services, and not to basic or service function in the economic support of a given area.[2] Between 1940 and 1950 the number of workers in agriculture in the United States diminished from 8.4 million to 7.1 million or about 15 per cent.[3] During this same period em-

[2] Cf. Richard B. Andrews, "Mechanics of the Urban Economic Base: The problem of Terminology," *Land Economics*, XXIX (August 1953): 266.

[3] *Statistical Abstract of the United States, 1952*, p. 185. During the same period farm output rose 24 per cent (*Agricultural Statistics, 1953*, p. 584).

ployment in secondary activities grew from 13.5 to 18.6 million or 37 per cent and in tertiary activities from 22.3 to 29.3 million or 31 per cent. These shifts are part of a long-run trend. Between 1820 and 1950 the proportion of occupied persons in primary activities in the United States shrank from 72 to 13 per cent, while that in secondary activities expanded from 12 to 33 per cent, and in tertiary from 15 to 53 per cent.[4] The location of the now dominant secondary and tertiary activities is not tied primarily to the distribution of raw materials, but exhibits a correspondence to the disposition of regional and national markets; yet these very markets are partly an outgrowth of the historical development of these self-same activities.[5]

In the location of manufacturing, as in economic activities in general, the distribution of raw materials is of decreasing weight. Materials undergo many processing stages from the crude raw material to the final product; in general the first stages are near the sources of raw materials, the intermediate stages somewhat footloose in location, and final stages close to the market.[6] Products are becoming more highly fabricated with the result that the initial treatment of raw material is diminishing in relative importance; the automobile is more intricate than the buggy and the mechanical refrigerator than the ice box. Within related industries employment in the final processing segments typically is growing more rapidly than in early or intermediate stages. Between 1939 and 1947, for example, the rate of increase of production workers in the apparel industries (final stage) was nearly five times as high as in textiles, and in machinery nearly three times as high as in primary metals.[7]

The production of iron and steel illustrates the decreasing significance of the location of raw materials in manufacturing. In the middle of the eighteenth century each ton of pig iron produced in Britain required about 8 tons of coal and 3 tons of

[4] See Colin Clark, *The Conditions of Economic Progress.* London, 1940. "The Flow of Labour to Tertiary Production," Chapter V, pp. 176–219; *idem., The Economics of 1960.* London, 1942. "The Trend of Secondary and Tertiary Productivity," Chapter III, pp. 22–32; and P. K. Whelpton, "Occupational Groups in the United States 1820–1920," *Journal of the American Statistical Association,* XXI (Sept. 1926): 339–340.

[5] The location of certain of these activities shows an increasing effect of amenity factors (Edward L. Ullman, "Amenities and Regional Growth," abstract in International Geographical Union, *XVIIth International Geographical Congress, United States, 1952. Abstracts of Papers,* "Publication No. 6." Washington, D. C., 1952. p. 92; full paper in the *Geographical Review,* XLIV (January 1954): 119–132. The importance of the market as a locational factor is recognized in Thomas R. Smith, "Locational Analysis of New Manufacturing Plants in the United States," *Tijdschrift voor Economische en Sociale Geographie,* XLV (February 1954): 46–50.

[6] U. S. National Resources Committee, *Structure of the American Economy, Part I, Basic Characteristics.* Washington, 1939. Chapter IV, "The Structure of Production—Geographical Structure," pp. 33–59.

[7] Production workers in textiles increased 1939–1947 from 1,082 to 1,147 thousands or 6 per cent, in apparel industries from 753 to 973 thousands or 29 per cent; in primary metals from 672 to 1,010 thousands or 50 per cent; in machinery from 784 to 1,883 thousands, or 140 per cent. (U. S. Bureau of the Census, *Census of Manufactures: 1947, Vol. II, Statistics by Industry.* Washington, 1949. p. 22.)

iron ore.[8] In the United States in 1952 for each ton of steel produced, only 1.2 tons of iron ore, 0.9 tons of coal, and 0.6 tons of scrap were consumed.[9] But about half the scrap comes from the market areas (the rest is produced within each plant). Excluding limestone, which is widely distributed, the ratio of the mined raw materials such as coal and iron ore to market-oriented materials such as purchased scrap and produced steel has sunk from 11 to 1 to a low of 1.6 to 1, or only a seventh as high. During this same period transportation and mechanized handling have become more efficient and much cheaper for bulky raw materials. Especially dramatic is the use of pipelines for the transmission of oil and natural gas. In general finished products do not lend themselves to bulk handling, but involve high labor costs in transportation. The truck, however, has benefitted short hauls of finished products.

The production of iron and steel, even though a raw-material-processing industry, exhibits the importance of the market factor.[10] At times the steel industry of

1952): 56-66.

Pittsburgh has been considered as "based mostly on the coking coal of the Connellsville district;"[11] it is equally an expression of superb central location amidst the huge markets of the American Manufacturing Belt. Malcolm Keir demonstrated that the iron industry of Pittsburgh arose in relation to the market; iron-using factories, such as rolling mills and plow works, preceded by many decades the production of pig iron in the city.[12] The conspicuous growth of the steel industry has been near markets, as symbolized by the founding of Gary near Chicago half a century ago and the recent construction of the Fairless Steel Works on the Delaware River convenient to New York City; both have low total transport costs by virtue of the cheapness of water carriage of distance ores and the proximity to markets.[13] In spite of the favorable juxtaposition of local coking coal, iron ore, and limestone, Birmingham, Alabama, has remained a small producer. The small size

[8] Walter Isard, "Some Locational Factors in the Iron and Steel Industry since the Early Nineteenth Century," *The Journal of Political Economy*, LVI (June 1948): 203–217, citation on p. 204. See also L. Dudley Stamp and Stanley H. Beaver, *The British Isles*. 3rd ed., London, 1941. p. 333.

[9] Production of steel 93 million tons; consumption of iron ore, 112 million tons, of coal (all purposes) 87 million tons (78 for coke), and of scrap 53 million tons (American Iron and Steel Institute, *Annual Statistical Report 1952*. New York, 1953. pp. 7, 15, 18, and 23. In addition fuel oil, natural gas, and purchased electric power supply significant amounts of energy.)

[10] Cf. Richard Hartshorne, "The Location of the Iron and Steel Industry," *Economic Geography*, IV (1928): 241–252; and Allan Rodgers, "Industrial Inertia, A Major Factor in the Location of the Steel Industry in the United States," *Geographical Review*, XLII (January

[11] L. Rodwell Jones and P. W. Bryan, *North America, An Historical, Economic and Regional Geography*. London, 1933. p. 289.

[12] Malcolm Keir, "The Iron and Steel Industry," *Manufacturing Industries in America, Fundamental Economic Factors*, Chapter V. New York, 1920. pp. 142–172, Pittsburgh on pp. 114–116. The opening sentence in this chapter announces Keir's theme, "The story of iron and steel in the United States turns about one central theme, the market for the products."

[13] Walter Isard and William M. Capron, "The Future Locational Pattern of Iron and Steel Production in the United States," *Journal of Political Economy*, LVII (April 1949): 118–133.

of the Southern markets has been one factor stunting its growth. Duluth near the iron ore deposits of Minnesota has stagnated because of distance from markets.[14] The general world distribution of the iron and steel industry exhibits a congruity with markets rather than with the distribution of coal, iron ore, or any other raw material.

LOCATION OF MARKETS

Population and markets are unevenly distributed over the United States. Many factors contribute to this irregularity: scanty rainfall in the western half, hence less agricultural settlement there; spotty distribution of other resources such as coal, petroleum, metalliferous ores, forests, level land, rich soil, water power; history of settlement, which advanced from the Eastern Seaboard, at which arose the main seaports and urban concentrations; the development of transportation facilities by water (canals, rivers, and the Great Lakes) and by land (road and railroad); the sequence of the rise and spread of modern manufacturing from New England westward into the present Manufacturing Belt; and many other factors.

Population is one measure of the market, but income or retail sales provide more adequate indices. For international comparisons national income serves well. Within the United States sharp regional differences in income level occur. In 1949 the median income per family in New Jersey was $3,670 or more than three times as high as in Mississippi, $1,198.[15] Thus the average family in New Jersey has about three times as much money to spend as the average family in Mississippi. Retail sales approximate the ultimate market for goods sold commercially to consumers. In spite of certain limitations, these sales appear to provide the most valuable single index of the total final market for commercial goods. Fortunately such figures are readily available by counties from the Census of Business, 1948.[16]

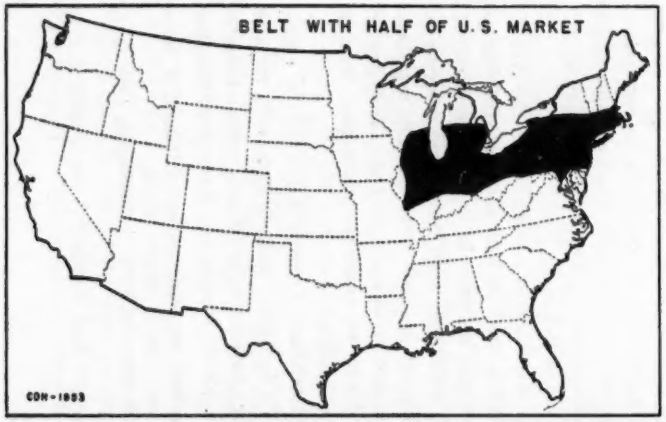
Half the retail sales in the United States are made in a small belt in the Northeast, extending from Boston to St. Louis (Fig. 1). A manufacturer distributing to a national market is likely to make about half his sales here. The development of industries in the South or the West has sometimes been considered evidence of a trend toward location near markets. Insofar as such developments represent branch plants to serve regional markets this interpretation is correct. Distribution costs from these areas to the total national market, however, run higher than in most parts of the Manufacturing Belt (Fig. 7 below).

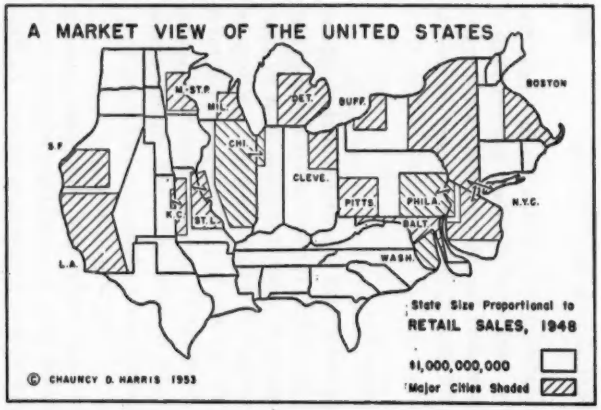
In terms of total size of market the Northeastern states dominate the entire country. On Figure 2 the area of each state has been made to vary with the size of the retail market in the state. The country appears to be afflicted with a hospital case of hydrocephalus, in which the head (from Illinois to Massachusetts) has

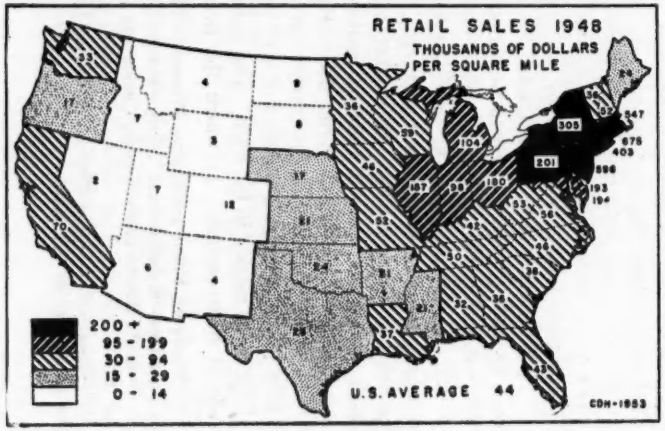
[14] Langdon White and George Primmer, "The Iron and Steel Industry of Duluth: A Study in Locational Maladjustment," *Geographical Review*, XXVII (1937): 82–91.

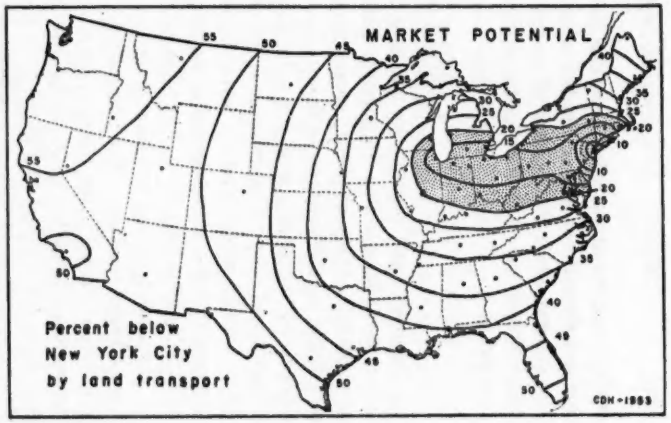
[15] U. S. Bureau of the Census, *County and City Data Book 1952*. Washington, 1953. p. 3, col. 20.

[16] *Ibid.*, col. 67. The 1949 edition giving the same data in column 2 was actually used in the tabulation for this paper.


BELT WITH HALF OF U.S. MARKET
CDH-1953


A MARKET VIEW OF THE UNITED STATES
M-ST.P
MIL.
DET.
BUFF.
BOSTON
S.F.
CHI.
CLEVE.
K.C.
ST.L.
PITTS.
PHILA.
N.Y.C.
BALT.
WASH
L.A.
State Size Proportional to
RETAIL SALES, 1948
$1,000,000,000
Major Cities Shaded
© CHAUNCY D. HARRIS 1953


RETAIL SALES 1948
THOUSANDS OF DOLLARS
PER SQUARE MILE
200 +
95 - 199
30 - 94
15 - 29
0 - 14
U.S. AVERAGE 44
CDH-1953


MARKET POTENTIAL
Percent below
New York City
by land transport
CDH-1953

swelled six times normal size to exceed in bulk the rest of the body. The shriveled Southeast hangs limply like the forelegs of a kangaroo. The Mountain States have atrophied and nearly disappeared. The giant New York Metropolitan Area is larger than all the Southern States on the Atlantic south of the Potomac. The Chicago Metropolitan Area takes the measure of Texas. Massachusetts equals the combined Mountain States.

Some states in the Northeast have a density of market several hundred times as high as other states in the West. The United States may be divided into five grades of decreasing intensity of market as follows (Fig. 3): 1) the Eastern Seaboard states extending from Massachusetts to Pennsylvania with very high densities, five to fifteen times the national average; 2) the western half of the Manufacturing Belt from Ohio to Illinois with densities several times the national average; 3) most of the rest of the eastern half of the United States with densities about the national average; 4) the central and southern Great Plains with low densities; and 5) the Mountain States and Dakotas with very low densities, only a twentieth to a fourth the national average.

In order to determine more exactly and quantitatively the relative accessibility of various parts of the United States to the widespread markets, two new measures are proposed in this paper: 1) the market potential and 2) the point of lowest transport cost to market. These will be discussed in turn.

THE MARKET POTENTIAL

The term market potential, suggested by Colin Clark, is analogous to that of population potential as proposed and mapped by John Q. Stewart.[17] It is an abstract index of the intensity of possible contact with markets. The concept is derived ultimately from physics, in which similar formulas are used in calculating the strength of a field, whether electrical, magnetic, or gravitational.

The market potential (P) is defined as the summation (Σ) of markets accessible to a point (M) divided by their distances from that point (d)

[17] John Q. Stewart, "Empirical Mathematical Rules Concerning the Distribution and Equilibrium of Population," *Geographical Review*, XXXVII (1947): 461–485, esp. 471–482; *idem.*, "Demographic Gravitation: Evidence and Applications," *Sociometry*, XI (1948): 31–58; *idem.*, "A Basis for Social Physics," *Impact of Science on Society*, III (1952): 110–133, esp. 118–122.

FIG. 1. Belt with half the retail sales in the United States in 1948. This belt occupies only 8 per cent of the country.

FIG. 2. A market view of the United States. The area of each state is proportional to the amount of retail sales in 1948. Sales of important metropolitan areas are indicated by shading. Some, such as New York City and Chicago, extend into more than one state. The Mountain states have been grouped as a single unit east of California.

FIG. 3. Intensity of the American market as measured by density of retail sales in 1948 by states.

FIG. 4. Distribution of market potential for the United States, based on retail sales in 1948 and on land transportation only. The points for which calculations were made are indicated by dots on this and on following similar maps. For method of calculation see the text.

$$P = \Sigma \left(\frac{M}{d} \right).$$

Two measures need to be selected and tabulated, one of the market and the other of distance.

A good measure of the over-all ultimate market for goods in the United States is provided by the figures for retail sales. These data have been tabulated on a county by county basis to give the values of M in the equation.

With respect to a measure of distance (d), for this purpose transport cost is superior to sheer miles. With the help of Harold M. Mayer, Colin Clark and I calculated generalized formulas for estimating transportation costs by road, rail or water between any two points in the United States. On the basis of studies in the Chicago area typical terminal and running costs were established and utilized. Thus it was found that local truck delivery within a city costs about $6 per ton and that running costs approximate an additional 4 cents per ton-mile.[18] Trucking costs thus are set at $6 for local delivery, $8 for movements up to 50 miles, $10 for 100 miles, $18 for 300 miles, etc. Beyond this distance railroad transport costs were utilized. These were calculated at $5 per ton rail terminal costs plus 2½ cents per ton-mile, plus truck delivery costs of $6 per ton at destination.[19] The rail rates work out at $22 per ton for 440 miles and $40 for 1160 miles, etc. Total costs per ton-mile decrease with distance because of the lessening proportion of terminal costs in long hauls. Thus the *total* cost including railroad terminal costs, truck delivery costs,

[18] These generalized truck cost figures are based on studies by Colin Clark and Harold M. Mayer, checked against a series of rates for specific items. The rates have been analyzed to separate out running costs from terminal costs. For example the rate on barbed wire, nails, and steel sheeting is estimated at 74¢ a hundred pounds for 100 miles, 92¢ for 200 miles, $1.12 for 300 miles (*Montgomery Ward Fall and Winter Catalogue* 1952–1953, p. 1041). The difference in rate between 100 and 200 miles is 18¢, and between 200 and 300 miles is 20¢, an average of 19¢. Multiply this figure for 100 pounds by 20 to get tons or $3.80 per ton for 100 miles or 3.8¢ per ton-mile for running costs. Subtract 19¢ running costs from 74¢ (for 100 miles) to get 55¢ terminal costs per 100 pounds or $11 per ton. For another example, the rates by public carrier for an 8-ton truckload of books from the Midwest Inter-Library Center in Chicago for delivery to the University of Chicago (½ mile) or to Illinois Institute of Technology (4 miles) is $56. (*Midwest Inter-Library Center Newsletter*, February 28, 1953, p. 8.) Both may be considered local delivery and the rate works out at $7 per ton. For delivery to the University of Minnesota at Minneapolis the rate is $208, or $26 per ton. Subtract $7 per ton for terminal charges and divide the remaining $19 per ton for running costs by 419 miles to get about 4½¢ per ton-mile for running costs.

[19] By the Illinois Central Railroad the rate on plows by carload lots from Chicago to St. Louis is 78¢ per 100 pounds, to Memphis $1.18, and to New Orleans $1.46. The corresponding figures per ton are $18.50, $28.00, and $34.60. It is 284 miles to St. Louis, 536 to Memphis, and 719 to New Orleans. The difference in rate from Chicago between St. Louis and Memphis is $9.50 per ton (252 miles hence 3.8¢ running costs per ton-mile) and between Memphis and New Orleans is $6.60 per ton (183 miles hence 3.6¢ running costs per ton mile). Taking figure of 3.6¢ per ton-mile running costs for the 284 miles between St. Louis and Chicago gives a figure of $10.22 for running costs between the two cities; this subtracted from the $18.50 rate leaves just over $8.00 for terminal costs. On this route for this commodity one could use figures of $8.00 per ton terminal and 3.6¢ per ton-mile additional running cost.

and a constant running cost per ton-mile declines from 5 cents per ton-mile for 440 miles to 3½ cents per ton-mile for 1160 miles. For intercoastal water transportation in the United States total terminal costs are estimated at $18 ($6 for terminal ship costs in the port; $6 for truck collection on land, and $6 for delivery by truck at destination). The running costs are very low, only ¼ cent per ton-mile. On the other hand the distances by sea may be much greater than by land. Inland waterways have not been included in the calculations.

It should be emphasized that these figures are estimated transport *costs* for simple manufactured goods not actual *rates* for any specific article.[20] Rates for bulk commodities, such as coal, are much lower. Whether a particular product takes a higher or lower rate would not affect the calculations significantly since the distance ratios would remain approximately the same.

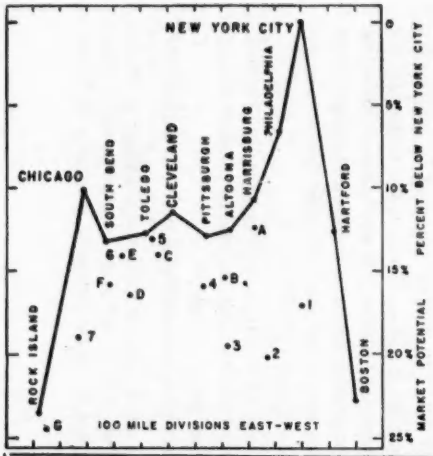
To determine the market potential (P) for a given city, one simply makes a summation (Σ) of the market potentials for that city of all counties in the area under consideration (the United States or a major region). The market potential of each county is the retail sales of that county divided by the transport cost of reaching the city for which the market potential is being calculated $\left(\frac{M}{d}\right)$.

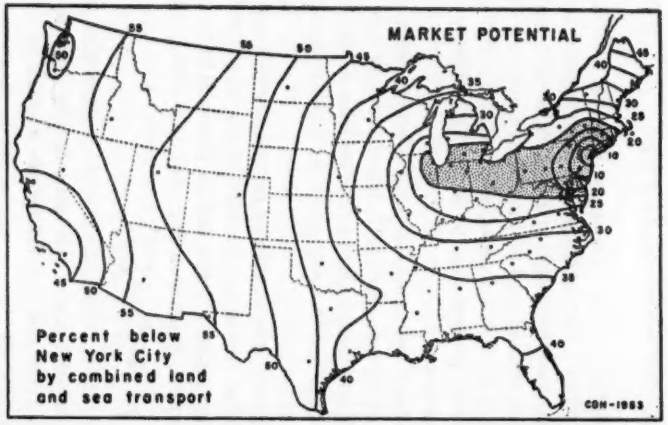
In making the calculations two assumptions are made: 1) that because the United States is covered by a dense network of highways and railroads, the shortest distances on a map are proportional to actual route miles and therefore it is not necessary to tabulate data for individual routes; and 2) that because of the large number of counties involved figures can be grouped into class intervals. In the actual computations concentric circles are drawn on tracing paper around each selected city representing transport costs of 6 (local county), 8, 10, 12, 14, 18, 22, 30, 40, 50, 60, 70, and 80 dollars. The retail sales of each concentric circle are calculated by simply adding the retail sales of all counties within the band included by that circle and not by a smaller circle. (The county figures are recorded on a base map that can be used over and over again.) The market potential of each band is then calculated by dividing the total sales of the band by the cost of reaching it from the city under consideration. The total market potential for this city is then obtained by adding the market potentials for all the bands or concentric circles. Dots on the maps indicate the cities for which these detailed calculations were made. On the basis of the values determined for these points, lines of equal market potential are drawn on maps, much as one draws contours or isotherms. For easier comparisons the figures are expressed as percentages of the city with the highest value (Fig. 4).

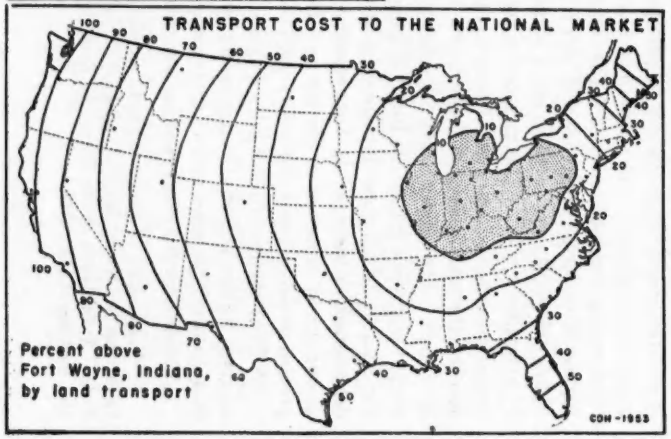
A fixed volume of retail sales within a city (transport cost $6) provides ten times as much market potential to this center as would the same volume of *total* retail sales in a county 1960 miles away (transport cost $60 by land).

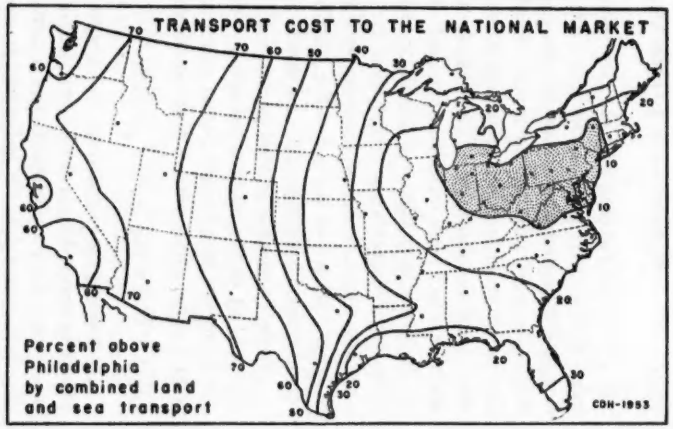
Validity for the concept of market potential as a meaningful index of accessibility

[20] For a series of maps and graphs showing actual rates for specific commodities as affected by distance see Stuart Daggett and John P. Carter, *The Structure of Transcontinental Railroad Rates.* Publications of the Bureau of Business and Economic Research, University of California, Berkeley, Calif., 1947.


NEW YORK CITY
CHICAGO
SOUTH BEND
TOLEDO
CLEVELAND
PITTSBURGH
ALTOONA
HARRISBURG
PHILADELPHIA
HARTFORD
BOSTON
ROCK ISLAND
100 MILE DIVISIONS EAST-WEST
PERCENT BELOW NEW YORK CITY
MARKET POTENTIAL
0
5%
10%
15%
20%
25%


MARKET POTENTIAL
Percent below
New York City
by combined land
and sea transport
CDH-1953


TRANSPORT COST TO THE NATIONAL MARKET
Percent above
Fort Wayne, Indiana,
by land transport
CDH-1953


TRANSPORT COST TO THE NATIONAL MARKET
Percent above
Philadelphia
by combined land
and sea transport
CDH-1953

to markets would seem to rest on a progressive decline in quantity of goods moved with increasing distance. Market potential appears to gauge the possible spatial interaction between producers and markets, of the likely flow of goods from a point to accessible regions.[21] A number of studies indicate that freight movement as well as many other types of relationships between any two points varies directly with their size and inversely with their distance apart.[22] Actually there is a complex hierarchy of distribution areas from any given city; some products may have national or international distribution, others regional, and many local only. The aggregation of these various distribution areas results in a large volume of local and nearby movement with amounts decreasing with distance, just as in a contour relief model of a hill, all layers are represented at the center, but a decreasing number as one moves outward to the edge. Walter Isard, who has undertaken research on the decrease of shipments with distance, estimates that within the United States the total tonnage of Class I railroad shipments varies inversely with distance raised to roughly the 1.7 power when a straight line is fitted to the data plotted on double log scale.[23] If the

[21] See Edward L. Ullman, "Human Geography and Area Research," *Annals of the Association of American Geographers,* XLIII (March 1953): 54–66; *idem., Maps of State-to-State Rail Freight Movement for 13 States of the United States in 1948,* Office of Naval Research, Contract N50RI–07633, Report No. 3, Harvard University, Cambridge, Mass., 1951 (preliminary); *idem.,* "Advances in Mapping Human Phenomena," reproduced in the same series as Report No. 5; *idem.,* and Walter Isard, *Toward a More Analytical Economic Geography: The Analysis of Flow Phenomena,* Report No. 1, in the same series. For a discussion of the relationship of population and distance in retail trade see: William J. Reilly, "Methods for the Study of Retail Relationships," *University of Texas Bulletin* No. 2944 (Bureau of Business Research, Research Monograph No. 4), November 22, 1929; *idem., The Law of Retail Gravitation,* New York, 1931, P. D. Converse. "New Laws of Retail Gravitation," *Journal of Marketing,* XIV (October 1949): 379–384; and Robert B. Reynolds, "A Test of the Law of Retail Gravitation," *Journal of Marketing,* XVII (January 1953): 273–277.

[22] See George K. Zipf, *Human Behavior and the Principle of Least Effort.* Cambridge, Mass., 1949. "The Factor of Distance," pp. 386–409; and Donald J. Bogue, "Distance from the Metropolis," chapter IV, *The Structure of the Metropolitan Community, A Study of Dominance and Subdominance.* Ann Arbor, Michigan, 1949. pp. 67–78.

[23] Walter Isard and Merton J. Peck, "Location Theory and International and Interregional Trade Theory," *Quarterly Journal of Economics, in press.* cf. Rutledge Vining, "Delimitation of Economic Areas: Statistical Conceptions in the Study of Spatial Structure of an Economic System," *Journal of the American Statistical Association,* XLVIII (March 1953): 44–64, especially charts 2 and 5.

FIG. 5. Market potentials for cities on or near the ridge of high potential between New York City and Chicago. Cities north of the ridge are indicated by numbers: 1. Albany; 2. Syracuse; 3. Buffalo; 4. Erie; 5. Detroit; 6. Battle Creek; and 7. Milwaukee. Cities south of the ridge are identified by letters: A. Baltimore; B. Cumberland, Md; C. Columbus, Ohio; D. Cincinnati; E. Fort Wayne; F. Indianapolis; and G. St. Louis. Cities are aligned according to position on an east-west axis.

FIG. 6. Distribution of market potential for the United States, by combined land and sea transport.

FIG. 7. Transport cost to the United States national market (as measured by retail sales in 1948) by land transport only. For method of calculation see the text.

FIG. 8. Transport cost to the United States national market by combined land and sea transport.

exponent were as low as 0, distance would have no effect. If it were as high as 3 (distance cubed), only nearby markets would have much weight. In total shipments utilized by Isard, bulky raw materials loom large. In the calculations of this paper I have used an exponent of 1, which may be approximately correct for manufactured goods. Research needs to be undertaken to calculate the actual values for different types of commodities and for different areas.

Areas of high market potential furnish especially suitable conditions for the development of manufacturing. Industries in which economies of scale are important find in the immense nearby markets a particularly favorable environment. The existence of a large and diversified labor force, the presence of many specialized services, the ease of obtaining components or sub-assemblies nearby, the presence of large industrial markets for new parts and gadgets, the ability to deliver quickly to the markets, and a host of other factors reinforce the transport advantages.

Areal Distribution of Market Potential

The market potential for the United States reaches a very high level in a broad belt between Massachusetts and Illinois and attains its maximum at New York City (Fig. 4, which is calculated on the basis of land transportation). The belt of high market potential extending east-west nearly coincides with the Manufacturing Belt. It stretches from Boston on the east to the Mississippi River on the west and from mid-Michigan on the north into Kentucky on the south. One of the interesting features of the westward extension of the area of high potential is the ridge of maximum potential, away from which the level drops sharply both to north and to south (Fig. 5). This ridge extends from New York City westward through Philadelphia, Harrisburg, Altoona, Pittsburgh, Cleveland, Toledo, and South Bend, to Chicago. Omitting the high peak for New York City on the east and the lower peak for Chicago on the west, the ridge is remarkably even, varying less than 2 per cent in height between Altoona on the east and South Bend on the west, and reaching its highest point in this section at Cleveland (Fig. 5). Baltimore (A in Fig. 5) lies south of the ridge and Detroit and Upper New York State (1–5 in Fig. 5), north of it. West of Chicago or east of New York City the market potential falls precipitately; in the 150 miles between Chicago and Rock Island or in the 180 miles between New York City and Boston it declines by a greater amount than anywhere in the 750-mile ridge of high potential between New York City and Chicago.

That the apex of market potential occurs in New York City reflects both the size of the city and its central position within the early settled, densely populated, highly urbanized Atlantic Seaboard extending from Boston on the north to Washington on the south.[24] A compact coastal belt includes Boston, New York City, Philadelphia, Baltimore, and Washington, 5 of the 11 cities in the United States with retail sales of more than 1 billion dollars in 1948 (Fig. 2). It contains 45 other counties with retail sales of more than 100 million dollars each. With a little more than 1 per cent

[24] See Jean Gottmann, "La Région Charnière de l'Économie Américaine," *Revue de "La Porte Océane,"* VII (March 1951) No. 71: 9–14 and VII (April 1951) No. 72: 11–20.

of the area of the country it accounts for nearly one-fourth of the total retail sales.[25] In this diminutive area more retail sales are made than in the 60 per cent of the United States west of the Mississippi River, excluding the Pacific Coast.[26] Another expression of the importance of the large compact market on the Eastern Seaboard is the market potential for the area within 200 miles of various cities. The market potential for New York City of the area within 200 miles only of the city is about eight times as great as for any Southern city within a similar area.[27]

The Southeastern United States is characterized by moderate market potentials. The belt of highest potential extends east-west and the Atlantic Coastline trends southwesterly. Coastal Georgia lies due south of Ohio, mid-way in the belt. Consequently all points in the Southeast have fair access to all parts of the belt. Greenville, S. C., for example, is closer to both New York City and Chicago than they are to each other.

The eastern corners of the country in Maine and in Florida have low market potentials. All their market support must be derived from a sector of less than a quarter of a circle, whereas inland points may draw sustenance from all directions.

The western areas have very low potentials. A minimum occurs in the Pacific Northwest, which is farther than the Southwest from eastern markets and which also contains a smaller local market.

The market potential rises in Southern California, the only major break in the otherwise persistent and regular decline away from New York City and the ridge of high market potential. The large local market accounts for this rise.

The differential between the market potential of the Eastern Seaboard ports and of Midwestern cities is heightened by the utilization of water transport, where cheaper (Fig. 6). Use of the sea roughly halves the cost of shipment between the Pacific Coast and the Atlantic Seaboard although ocean routes are much longer than land routes. Water transportation gives the Gulf Coast cheaper access to the immense markets of both the east and west coasts. The Pacific Coast potentials, although still lower than those of the East, rise above other parts of the West. By combined land and sea transport the Mountain States form a trough of low potential in contrast to a continuous decline to the Pacific Coast for land transport. Most of the goods move by rail, but the rates on the coast are lowered by the competition of water transport. The sharp impact of cheap ocean transportation shows more clearly in the second measure of accessibility, the point of lowest transport costs to market.

[25] 38,000 square miles or 1.3 per cent of the area of the United States; $29.9 billion in retail sales in 1948 or 22.9 per cent of the total for the United States.

[26] The eight Mountain States, seven West North Central States, and four West South Central States with an area of 1,798,000 square miles and retail sales of $28.6 billion in 1948.

[27] Knoxville, Tenn., Greensboro, N. C., Atlanta, Ga., and Greenville, S. C., in that order, have the highest market potentials within 200 miles in the South. Houston and Dallas, by virtue of their size, have higher potentials within 100 miles, but less intense markets in the intermediate umlands.

COMPARATIVE TRANSPORT COSTS TO MARKET

Assume that a manufacturer is to serve an entire market area, is to absorb the costs of shipment, and wishes to locate so as to minimize his freight costs to market or, to use Isard's term, his distance inputs.[28] What will his location be?[29] Here instead of maximizing the summation of sales divided by distance as in market potential, one sets out to minimize the summation of sales multiplied by the transport costs, according to the formula.

$$T = \Sigma(Md),$$

where T is total transportation costs to an aggregate of market areas, M is the size of the market in each unit (county in this case), and d is the distance in transport costs from any given city to the market in this unit (county). The same transportation cost figures, assumptions, and methods are utilized as in the calculation of the market potential.

In contrast to market potential, the point of lowest transport costs is only slightly affected by cheap local deliveries and is dominated by expensive distant shipments.[30] For example, the retail sales of the Pacific Coast amount to 11.4 per cent of the total sales for the United States, yet because of their distance account for only 4.6 per cent of the market potential for Chicago, but for 22.0 per cent of the freight cost of serving a national market from Chicago. Market potential presupposes a declining market with distance, whereas the transport cost calculations postulate that the size of the market is unaffected by distance within the area being measured.

Areal Distribution of Comparative Transport Costs

The area with lowest transport costs to serve the entire United States market by land transportation has an interior position centered on Fort Wayne, Indiana (Fig. 7). It lies within the belt of high sales in the northeastern United States, but in the western part of it because of the small, yet distant, markets west of the Mississippi River. The area with transport costs less than 10 per cent higher than Fort Wayne extends from Harrisburg on the east to St. Louis on the west. Beyond this, transport costs rise regularly in all directions to reach 50 per cent higher costs in eastern Maine or southern Florida and 100 per cent higher costs along the Pacific Coast.

Philadelphia, at the point where the Chicago–New York axis of largest market intercepts the margin of cheap sea carriage, has the lowest transport costs to the na-

[28] Walter Isard, "Distance Inputs and the Space-Economy," *Quarterly Journal of Economics*, LXV (1951): "Part I: The Conceptual Framework," 181–198; "Part II: The Locational Equilibrium of the Firm," 373–399. Isard is concerned with total distance inputs on materials as well as products.

[29] Cf. Leonard C. Yaseen, *Plant Location*. Roslyn, N. Y., 1952. Chapter III "Competitive Advantages in Raw Materials, Sources and Markets," pp. 21–38.

[30] In this it is similar to the "center of population" as calculated by the U. S. Bureau of the Census. See "Center of Population of the United States: 1950," *U. S. Bureau of the Census, Geographic Reports*, No. 2. Washington, September 30, 1951. See also E. E. Sviatlovsky and Walter Crosby Eells, "The Centrographical Method and Regional Analysis," *Geographical Review*, XXVII (April 1937): 240–254.

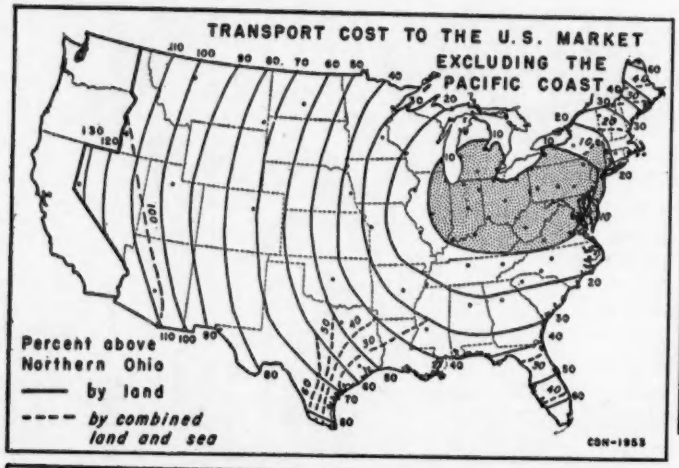
tional market by combined land and sea movement (Fig. 8). Most parts of the Manufacturing Belt fall within the area with transport costs less than 10 per cent above Philadelphia. This area reaches on the north to Albany and Detroit, on the west to Chicago, and on the south to Cincinnati and Roanoke.

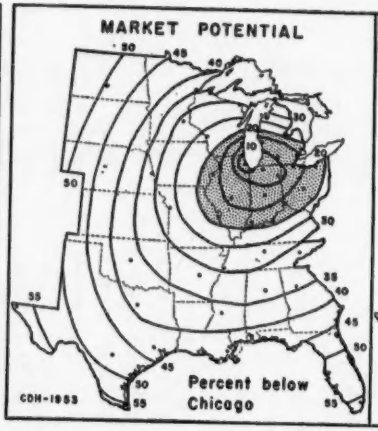
The Gulf and Pacific coasts are especially benefitted by water transport (cf. Fig. 7 and 8). The Gulf Coast possesses cheap water transport to the Atlantic Seaboard and to the Pacific Coast. Houston, Texas, by land transport has costs 40 per cent above the minimum point, but by combined land and sea only 18 per cent. Nevertheless, it is still higher than points within the Manufacturing Belt, for even by water transport, freight costs are heavy to the belt of high retail sales. San Francisco by land transport has costs 102 per cent above the minimum point, but by combined land and sea only 56 per cent higher. The sharp difference between land and sea costs is probably a major factor in the clustering of the population on the Pacific Coast around the seaports: Los Angeles, San Francisco, Portland, and Seattle. The Mountain States constitute a plateau of highest transport costs by combined land and sea transport—more than 70 per cent above the minimum point.

The large size of the market on the Pacific Coast and its remoteness and consequent high transport cost from other parts of the country encourage the development of an independent market area. James J. Parsons has noted the rise of industries here in response to the Western market.[31] On the basis of the possibility that the Pacific market may become somewhat independent, let us re-examine our figures. Since the area is relatively distant from the eastern United States its removal will not greatly affect figures for market potential, but its separation would sharply reduce the freight bill for many Eastern concerns. The points of lowest transport costs to the national market, excluding the Pacific Coast, have interior locations, whether transport is by land alone or by combined land and sea (Fig. 9). Fort Wayne and Cleveland have the lowest costs. The Gulf Coast, the Atlantic Seaboard, and Florida benefit from sea transport but not enough to offset more central location of interior points.

The Midwestern parts of the Manufacturing Belt combine central position within the belt of high retail sales with fair access to the markets of the South and the West. Points outside this belt have higher transport costs to national markets simply because they have to ship so much into the belt. St. Louis, for example, at the western edge of the belt, has a high freight bill because of having to transmit large amounts long distances to the huge markets of the Atlantic Seaboard. Boston, on the other end, has much freight moving long distances into the big markets of the Midwest. Ohio, Indiana, and Pennsylvania in the central part of the belt of high retail sales have the most favorable position for minimizing transport costs to market. The automobile industry is localized in this area. Its development to the north of the center of the area may be due in part to historical circumstances and possibly in part also to the pull of the Canadian market in this direction. Within the Manufacturing

[31] James J. Parsons, "California Manufacturing," *Geographical Review*, XXXIX (1949): 240.


TRANSPORT COST TO THE U.S. MARKET
EXCLUDING THE
PACIFIC COAST
Percent above
Northern Ohio
—— by land
---- by combined
land and sea
CDH-1953


MARKET POTENTIAL
Percent below
Chicago
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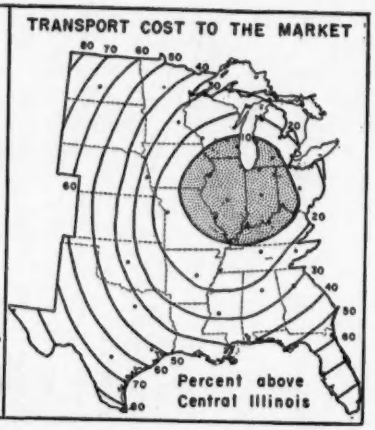
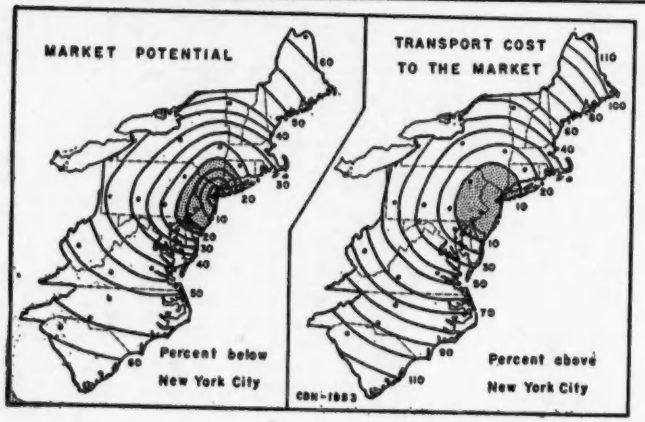
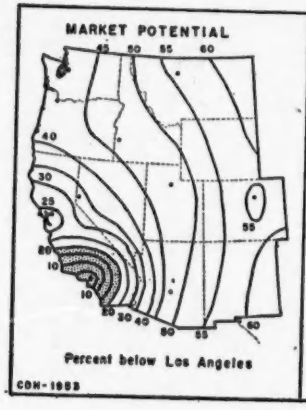
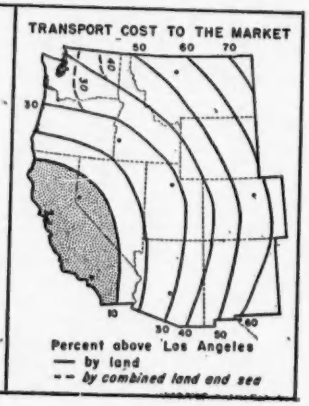

TRANSPORT COST TO THE MARKET
Percent above
Central Illinois


MARKET POTENTIAL
Percent below
New York City
TRANSPORT COST
TO THE MARKET
Percent above
New York City
CDH-1953


MARKET POTENTIAL
Percent below Los Angeles
CDH-1953


TRANSPORT COST TO THE MARKET
Percent above Los Angeles
— by land
-- by combined land and sea

Belt, New England with costs 10–20 per cent above those of the central part lies in a disadvantageous position for industries in which cost of transportation to market is a significant localizing factor. It is interesting that the shift of textile industries from New England to the South has not significantly altered the transport cost to market. Figure 9 is thought to be a fair approximation of the relative favorableness of various areas for the location of industries to serve the national market (excluding the Pacific Coast), insofar as these industries are transport oriented with respect to market.

Thus far the market has been considered in national terms and for all products taken together. Now we turn first to an analysis of regional markets, and secondly to the various segments of the national market.

REGIONAL MARKETS

The general decline in market potential outward from New York City is interrupted by a slight rise in only three places, each of particular significance: Cleveland, Chicago, and Los Angeles (Figs. 5 and 6). Cleveland represents the area in northern Ohio with lowest transport costs to serve the national market (excluding the Pacific Coast) (Fig. 9) and also the point with lowest land transport costs to manufacturing markets or sources of supply (Fig. 29). Chicago and Los Angeles, in addition to many other functions, serve as regional centers for the Central and Western segments of the country. New York City, although the center of the most intense markets (Figs. 2 and 3), has a coastal peripheral position for the country as a whole. It was natural therefore that an interior point such as Chicago should arise at some favorable location for inland markets, and should become the center of the railroad network. As noted, the Pacific Coast offers favorable conditions for the rise of independent sources of supply; Los Angeles is becoming its center.

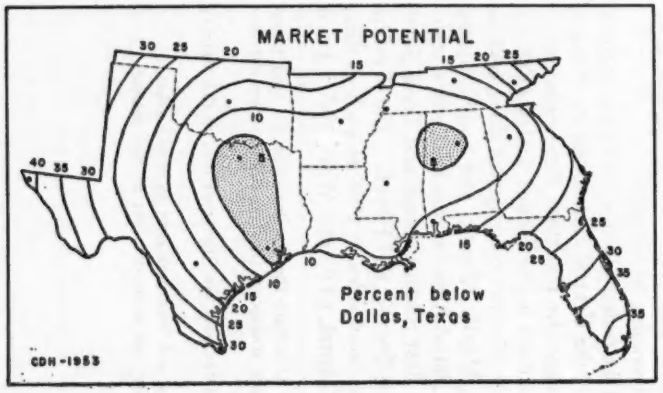
The largest convenient areal subdivision of the country is into three great regional segments: the East served by New York City, the Central area served by Chicago, and the West served by Los Angeles. It is suggestive that these three cities constitute in themselves the largest metropolitan markets in the United States (Fig. 2). If divisions are drawn at points approximately mid-way between the three centers, the Eastern area includes the New England, Middle Atlantic, and South Atlantic states, except for Georgia and Florida. The Central Area includes the Central states —East North Central, West North Central, East South Central, and West South Central (the census names are significant) plus Georgia and Florida. The West includes the Pacific and Mountain states. The retail sales in 1948 in each of these three areas were East, 47.1 billion dollars; Central, 64.0; and West, 19.5. These

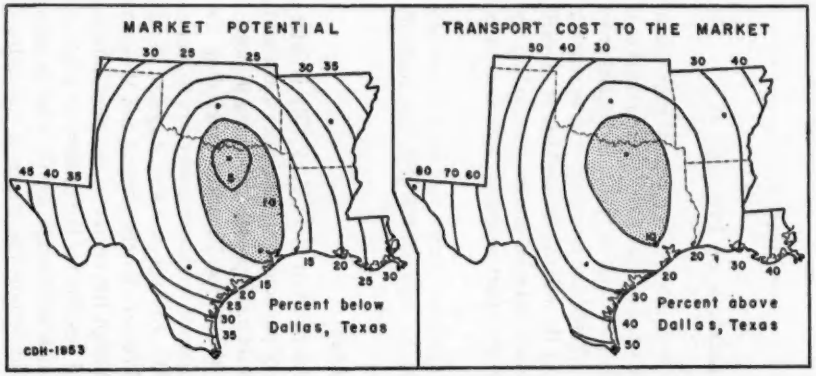
FIG. 9. Transport cost to the national market excluding the Pacific Coast by land transport only (solid lines) or by combined land and sea transport (dashed lines where different from lines for land transport only).

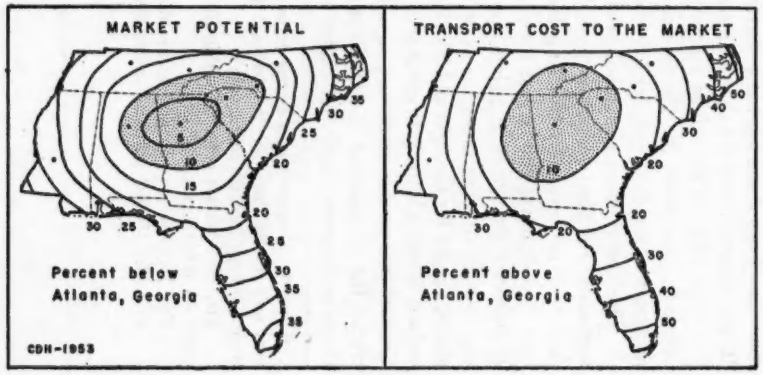
FIG. 10. Market potential within the Central states only and transport cost to this market, based on retail trade 1948.

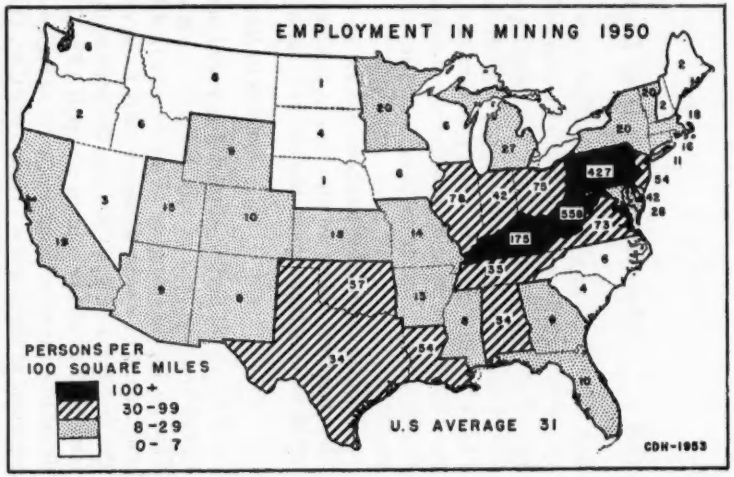
FIG. 11. Market potential within the East only and transport cost to this market.

FIG. 12. Market potential within the West only and transport cost to this market.


MARKET POTENTIAL
Percent below
Dallas, Texas
CDH-1953


MARKET POTENTIAL
Percent below
Dallas, Texas
CDH-1953
TRANSPORT COST TO THE MARKET
Percent above
Dallas, Texas


MARKET POTENTIAL
Percent below
Atlanta, Georgia
CDH-1953
TRANSPORT COST TO THE MARKET
Percent above
Atlanta, Georgia


EMPLOYMENT IN MINING 1950
PERSONS PER
100 SQUARE MILES
100+
30-99
8-29
0- 7
U.S AVERAGE 31
CDH-1953

three areas will be considered in turn.[32] Then the South, which poses special problems, will be treated separately.

The Central Market

The point of highest market potential within the central area is at Chicago (Fig. 10). The entire Midwestern part of the Manufacturing Belt possesses a relatively high potential, less than 20 per cent below Chicago. The potential declines more or less regularly to the corners in North Dakota, Texas, and Florida with minima of less than 50 per cent of the Chicago potential.

The point of lowest transport cost to the central area lies south of Chicago in central Illinois (Fig. 10). Decatur has the lowest transport cost to the central market of any city calculated, but some uncalculated point might have slightly lower costs. The area with transport costs less than 10 per cent above central Illinois extends from mid-Ohio on the east to mid-Missouri on the west, and from southern Wisconsin and Michigan on the north, to the Tennessee line on the south. Beyond this, costs rise in all directions to the corners, with El Paso and Miami having transport costs to the central market 80 per cent higher than central Illinois.

The East

New York City has by far the highest market potential in the East, just as it has in the entire country (Fig. 11). The Eastern part of the Manufacturing Belt has a market potential, for the most part, less than 40 per cent below New York City. Beyond it northern New England and the Carolinas extend as two wings of much lower potential. New York City also has the lowest transport cost to serve the Eastern market.

The West

Los Angeles increasingly dominates the West. It now has by far the highest market potential in the west (Fig. 12). In spite of its peripheral position it also has the lowest transport costs to reach the western markets. One-third of the retail sales of the entire West are made to the nearby markets of Southern California (Fig. 2). The next largest market, in the San Francisco area, is only half as large. These two small areas contain half the markets of the West. Unlike the East, where settlement is more or less continuous (although, of course, differing in density), the West is made up of a series of oases, which contain most of the population and the bulk of the

[32] For an analysis of major industry groups into those with national, regional, sub-regional, or local market areas see Walter Isard, "Some Empirical Results and Problems of Regional Input-Output Analysis," Chapter 5 in *Studies in the Structure of the American Economy by* Wassily Leontief and others. New York, 1953. pp. 116–181.

FIG. 13. Market potential within the South Central states.
FIG. 14. Market potential and transport cost, West South Central states.
FIG. 15. Market potential and transport cost, the Southeast.
FIG. 16. Density of employment in mining in the United States in 1950 by states.

markets. The largest of the areas of dense settlement has become the main center for the entire region.[33]

The South

The Central area, the largest, might be split into two areas, a North Central and a South Central. Since the North Central has a market more than twice as large as the South Central (43.9 billion dollars of retail sales in 1948 compared with 20.1) it predominates in the combined area. Separate maps for the potential and transport costs of the North Central do not differ substantially from those of the *whole* central area, except that Chicago becomes the point not only of highest potential, but also of lowest transport cost.

The South Central area lacks a commanding center. The highest potential for this area occurs in Dallas, Texas, in the western part, but much of the area has a potential at least 90 per cent as high (Fig. 13). Closer examination reveals a secondary peak farther east. This secondary peak occurs at Birmingham, Alabama, within the area here defined, but shifts eastward to Atlanta if the Carolinas are included.

The South falls naturally not into one market area, but into two, separated by the lesser markets near the Mississippi River in the states of Arkansas and Mississippi. In income level they are the lowest states in the Union with median family incomes in 1949 of $1501 and $1198 respectively, compared with $2248 for the South as a whole and $3073 for the entire country.[34] In terms of another measure, density of market as measured by retail sales per square mile, they are the lowest states in the eastern half of the United States and also in the South; their level is lower than Oklahoma and Texas on the west, both of which have large arid and semiarid regions; and is only about half as high as either Tennessee or Louisiana (Fig. 3).

The Southwest (Texas, Oklahoma, Louisiana, and Arkansas) has a clear focus in Dallas, which has both the highest market potential and the lowest transport costs to this market (Fig. 14). Dallas is well located to compete also in the adjoining states of New Mexico and Kansas.

For the Southeast as a separate area, including the Carolinas,[35] the clear focus is Atlanta with both the highest potential and the lowest transport costs to market (Fig. 15). If one were to include the border states of Kentucky, West Virginia, and Virginia to form yet a larger Southeast, Atlanta would retain its position as the center with the highest market potential, but the point of lowest transport cost would shift to Knoxville, Tennessee. But the main markets of Kentucky face the Ohio River and most of the state is an area of poor market, comparable with Mississippi and Arkansas. Just as the tails of comets point away from centers of gravity, so tributary areas tend to have their greatest extent away from competing centers of

[33] Cf. Chauncy D. Harris, "Location of Salt Lake City," *Economic Geography*, XVII (1941): 204.

[34] *County and City Data Book 1952*. p. 3, col. 20.

[35] The removal of the Carolinas does not greatly alter the patterns of market potential or transport costs of the East (Fig. 12).

higher market potential. Thus, Kentucky, West Virginia, and Virginia tend to be drawn into the orbit of the high potential to the North.

We now turn from general regional markets to specific segments of the national market as typified by mining, by agriculture, and by manufacturing itself.

SEGMENTS OF THE NATIONAL ECONOMY

The location of manufacturing is strongly influenced by the distribution of other economic activities; these produce industrial raw materials, provide in themselves markets for specific industrial goods, and support people who constitute the markets for manufactured consumers' goods. In the following pages no attempt will be made to treat comprehensively each of these three types of relationships between other activities and manufacturing, but rather merely to illustrate possible lines of inquiry.

On the basis of locational patterns economic activities may be divided into three broad groups. First, some activities must be carried on at the location of raw materials or in areas of certain combinations of natural conditions. Mining is possible only where the minerals or fuels occur. Farming can best be pursued under suitable combinations of temperature, rainfall, soil, terrain, and other conditions. Forestry must be undertaken where forests will grow. Such activities supported less than 15 per cent of the labor force in the United States in 1950. Because, superficially at least, they are tied to specific places, they play a relatively rigid role in the localization of other economic activities. Secondly, some activities are carried on near the immediate local market. Construction, retail trade, and service activities usually are performed close to the customers, wherever located. Thirdly, some activities are more flexible in their location, or more complex. As noted in the introduction, manufacturing is an assemblage of industries with differing locational requirements. Nevertheless, manufacturing as a whole, with 25 per cent of the labor force, is not as directly tied to local raw materials as is mining or to local markets as is retail trade.

Each of these great segments of the economy has a somewhat different distribution. We have already examined the areal disposition of retail trade as an index of the total market (Figs. 2 and 3). Let us now examine the mining, agricultural, and manufacturing segments of the economy. In 1929 some 28 per cent of the raw materials used in manufacturing (by cost) came ultimately from mining and 67 per cent from agriculture.[36]

Mining

Employment in mining in the United States is highly localized with the heaviest concentration on the Appalachian Coalfield from Pennsylvania through West Virginia to Kentucky (Figs. 16 and 17). Other areas of major employment in coal mining include other states with segments of the Appalachian Coalfield (Virginia to Alabama) and states with interior fields (Illinois and Indiana). The states with large employment in petroleum include Oklahoma, Texas, and Louisiana. In terms of employment, the states producing metalliferous ores lag far behind.

[36] U. S. Bureau of the Census, *Materials Used in Manufactures: 1929*. By Tracy E. Thompson. Washington, 1933. Table 1, p. 4.

The area with the lowest cost of reaching the population dependent on mining lies along the axis of the Appalachian coalfield (Fig. 18). Employment in mining is dominated by coal and coal is dominated by the Appalachian field.[37] This map would be a reasonably good measure of the relative cost of reaching the segment of the American consumer's market accounted for by persons employed in mining. With respect to mining as a productive activity with markets for mining machinery, some other criterion, such as capital investment in mining, would be a better measure. The same method would apply, however.

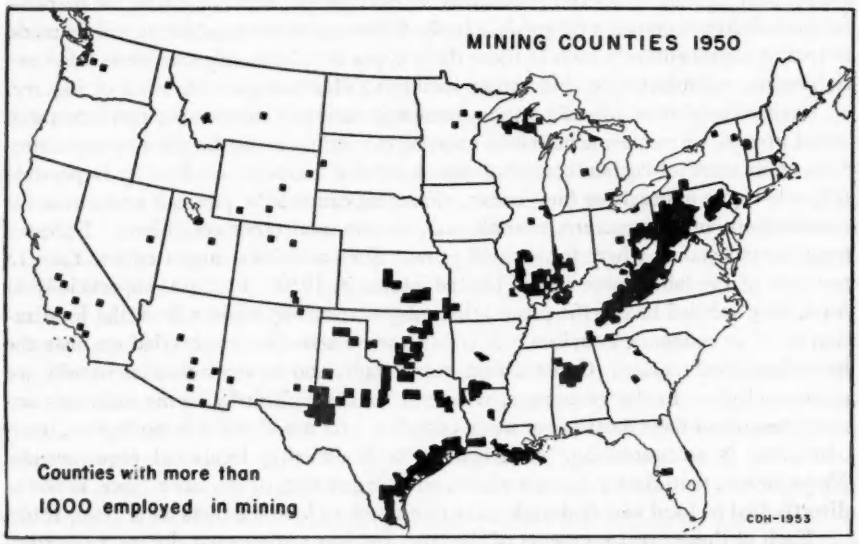


FIG. 17. Counties in the United States with more than 1000 employed in mining in 1950. In order not to overemphasize certain large counties in the Western United States, they have been represented by a symbol, the size of a typical county.

Mining can be considered in relation to manufacturing not only as a market, but also as a source of raw material or of fuel. During and after the Industrial Revolution in Britain there was a strong development of industry in the coal-mining districts in order to be near the new inanimate source of power. Thus in 1700 before the great development of mining, the highest densities of population in England were in the southern counties, but after the Industrial Revolution and the use of coal in industry, the main industrial districts developed on the coalfields.[38] In the United

[37] Raymond E. Murphy and Hugh E. Spittal have calculated the center of coal production in the Appalachian field for successive decades from 1869 and have mapped its southward migration in "Movements of the Center of Coal Mining in the Appalachian Plateaus," *Geographical Review*, XXXV (October 1945): 624–633. See also *idem.*, "A New Production Map of the Appalachian Bituminous Coal Region," *Annals of the Association of American Geographers*, XXXIV (September 1944): 164–172.

States, however, the distributions of employment in mining and in manufacturing have utterly different patterns, both in general and in detail. Only where the mining districts cross the axis of high market potential in Pennsylvania do mining and manufacturing coincide. The coal-mining states of West Virginia and Kentucky have a lower density of employment in manufacturing than any adjacent states. In detail, the actual mining districts in southern West Virginia, in southeastern Kentucky, and in western Kentucky are virtually devoid of manufacturing activities (Figs. 17 and 27). In Illinois the mines are in the south, but the manufacturing is mainly in the north. In these specific districts manufacturing has not developed at the source of power. How is this apparent exception to the oft-stated general rule, or to the distribution in Britain, to be explained? In the United States mining arose *after* the development of the railroad and the power thus could be brought from rugged mining districts to existing industrial areas or to points with a favorable combination of terrain, market, labor, transportation, and other conditions. Certain types of fuel-oriented industries, of course, have been attracted to the centers of energy, either of coal (as in Charleston, West Virginia) or of natural gas (as in Texas), or of water power (as in the Pacific Northwest or the southern Appalachians).

In the United States manufacturing has not shifted to the coalfields, but rather those coalfields convenient to industrial and other markets have been highly developed and others in isolated positions have been largely ignored. The Appalachian field contains only one-seventh of the reserves of coal in the United States, or one-third of the bituminous coal, yet it furnishes about three-fourths of the production.[39] The Rocky Mountains and the Northern Great Plains possess two-thirds of the country's coal reserves yet mine only 4 per cent of the output. Many factors are involved, but none is more important than location with respect to markets. Since petroleum is more concentrated and more valuable than coal, the location of its production is less affected by proximity to markets.

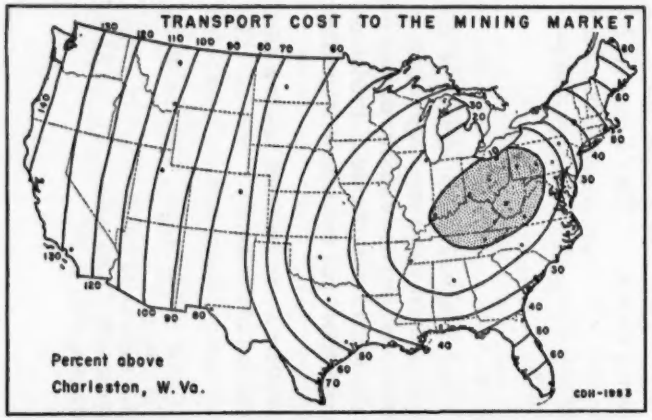
Agriculture

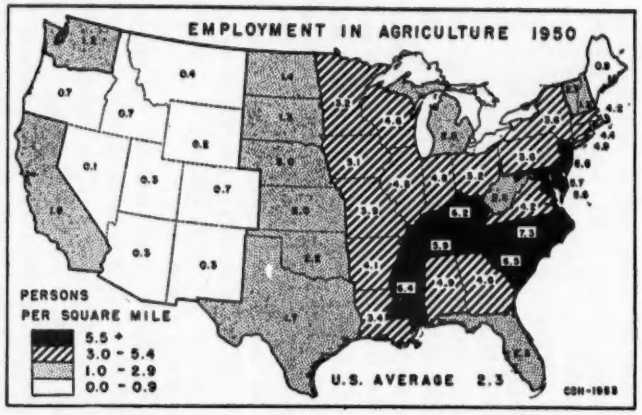
The farm market constitutes the largest and most widespread segment of the American market tied to the location of specific natural conditions. Agriculture is a space-using activity in which each production unit requires considerable area in harvesting the energy received on the earth's surface from the sun. Production therefore is diffuse and rural rather than concentrated and urban as in most other economic pursuits.

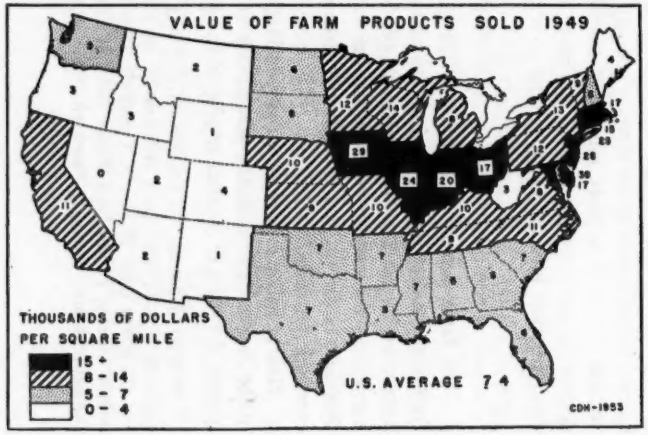
Nearly half the persons employed in agriculture are in the South, about a third in the North Central states, and a sixth in the rest of the country (Table I). The highest densities of persons employed in agriculture per square mile are in the South

[38] Wilfred Smith, *An Economic Geography of Great Britain.* London, 1949. pp. 69–135, especially p. 121; and Stamp and Beaver, *op. cit.*, pp. 550–551.

[39] Figures from Marius R. Campbell, "The Coal Fields of the United States," *U. S. Geological Survey, Professional Paper 100.* Washington, 1929. Table facing p. 24; and U. S. Bureau of Mines, *Minerals Yearbook 1949.* Washington, 1951. p. 292.


TRANSPORT COST TO THE MINING MARKET
Percent above
Charleston, W. Va.
CDH-1953


EMPLOYMENT IN AGRICULTURE 1950
PERSONS
PER SQUARE MILE
5.5 +
3.0 - 5.4
1.0 - 2.9
0.0 - 0.9
U.S. AVERAGE 2.3
CDH-1953


VALUE OF FARM PRODUCTS SOLD 1949
THOUSANDS OF DOLLARS
PER SQUARE MILE
15 +
8 - 14
5 - 7
0 - 4
U.S. AVERAGE 7 4
CDH-1953

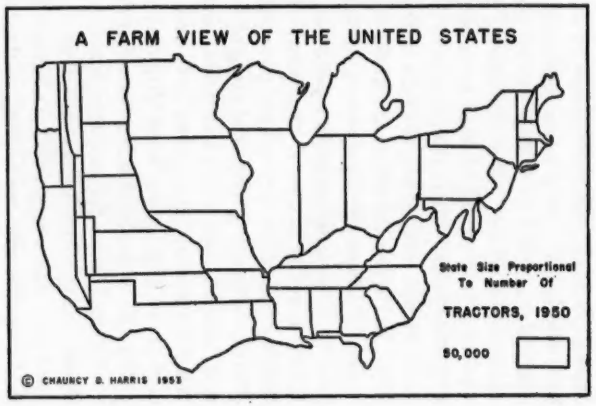

A FARM VIEW OF THE UNITED STATES
State Size Proportional
To Number Of
TRACTORS, 1950
50,000
© CHAUNCY D. HARRIS 1953

TABLE I

Employment in Agriculture, Farm Products Sold, and Number of Tractors on Farms in the United States by Regions, 1950 (percentage of total for the United States)

	Employment in Agriculture	Farm Products Sold	Tractors on Farms
Northeast	7.5	8.7	9.3
North Central	34.5	44.1	53.2
South	47.2	28.9	25.6
West	10.8	18.3	11.9
United States	100.0	100.0	100.0

Calculated from figures in *County and City Data Book 1952.* p. 4, col. 37; p. 8, col. 105; and p. 9, col. 115.

(Fig. 19). Parts of the Atlantic Seaboard also have a high density of agricultural population.

Value of farm products sold rather than population supported really measures the size of the agricultural market for commercial goods (Table I). The value of farm products sold per farm worker in 1950 was five times as high in Iowa as in Mississippi ($5700 compared with $1100).[40] Farm income per square mile gauges the areal intensity of the farmer's ability to purchase goods and services. Two areas of highest productivity per square mile stand out: the Corn Belt states, and the Atlantic Seaboard (Fig. 20). These are joined on north and south by east-west belts of high productivity, from Vermont to Minnesota on the north, and from North Carolina to Kansas on the south. South of this a belt of low productivity per square mile extends from South Carolina to Texas. The mountain and desert states have the lowest level of productivity per square mile. California stands out with productivity per square mile more than twice as high as any other state in the West.

Tractors are a good index of mechanized agriculture and of the market for durable manufactured goods in agriculture as a productive activity. The agricultural market of the United States as seen by a tractor manufacturer differs sharply from the total national market (cf. Figs. 2 and 21). Half the tractors are in the North Central States, which form the central body of the market, with appendages to the South (one-fourth) and to the Northeast and West (one-eighth each) (Table I). On Figure 21 Iowa is larger than Texas and about twice the size of California or New York. A belt of maximum density of tractors extends from Iowa on the west through Ohio on the east (Figs. 22 and 23); this is approximately the area of the Corn Belt. North and east of this belt is another, the Dairy Belt, with high density

[40] *County and City Data Book 1952.* p. 8, col. 105 divided by p. 4, col. 37.

FIG. 18. Transport cost to the national mining market as measured by employment in mining in 1950. By land transport only.

FIG. 19. Density of employment in agriculture 1950 by states.

FIG. 20. Density of value of farm products sold 1949 by states.

FIG. 21. A farm view of the United States as seen by the tractor manufacturer. Areas of states are proportional to the number of tractors in 1950.

extending from Minnesota on the west through New York and Connecticut on the east. Most other parts of the United States have a moderate density except the Mountain States and a few others which have a low density.

Peoria, Illinois, is the point of highest potential for the agricultural market (measured by the summation of number of tractors divided by transport cost) (Fig. 24). The area with very high potential (less than 10 per cent below that of Peoria) includes a large segment of the Corn Belt. Because of the widely spread character of agriculture, the gradient of market potential away from the highest point is far less steep in the case of tractors than in total market potential. From the central area of very high potential the decline is fairly regular in all directions. The corners of the country, Maine and Florida, have potentials 50 per cent as high as Peoria, but barely higher than the Pacific Coast. There are no secondary centers in which the potential for tractors rises sharply in such a way as to suggest that they would provide clear centers of production for a regional market. Tractor distribution is mainly national, but certain types of machinery, such as mechanical cotton pickers, have regionally localized markets.[41]

The point of lowest transport cost to the tractor market is also at Peoria (Fig. 25). The general pattern of transport costs resembles that of market potential. The eastern part of the Manufacturing Belt has high costs of distribution to the tractor market. Distribution costs to the national tractor market from Philadelphia are higher than from Denver.

The tractor market illustrates par excellance an interior market, far from the peripheral seas. The land transport cost rises 40 per cent above that of Peoria before the sea is reached on either the Atlantic Ocean or the Gulf of Mexico. Points on the perimeter, such as ports, that have developed into large metropolitan industrial and commercial centers play little role with respect to tractors.

The agricultural machinery industry had its origin farther east, but shifted westward to Illinois to the point of lowest transport cost to the agricultural market. Peoria, Rock Island, and Chicago, points with the lowest transport costs to market and highest potential, have become major tractor-manufacturing centers. Why did Des Moines, Iowa, with about the same market potential and transport cost as Chicago, not become a center of tractor production? One factor is the total transfer costs rather than just the transport costs to market. The main raw material utilized in the manufacture of tractors, as of other farm machinery, is steel. The sources of this raw material lie east of the tractor market in the steel mills of Chicago or of other cities yet farther east. The point which minimizes transfer costs lies between the sources of the raw material and the market, the exact point depending on the extent to which the manufacturing process increases or decreases the materials to be shipped (in terms of freight costs rather than bulk, since manufactured goods gen-

[41] Factories for mechanical cotton pickers are being located with reference to the market areas by International Harvester at Memphis, Tennessee, and by Allis Chalmers at Gadsden, Alabama (Glenn E. McLaughlin and Stefan Robock, *Why Industry Moves South, A Study of Factors Influencing the Recent Location of Manufacturing Plants in the South*, "National Planning Association, Committee of the South, Report No. 3." Washington, 1949. pp. 40–41).

erally have higher rates than raw materials). The cost of shipping tractors is higher than the cost of shipping the metals out of which they are made, and so tractor production tends to move toward the areas from which cheapest shipment to the total market can be made, but to remain on the side of that area facing the source of materials and parts.

Manufacturing

Manufacturing is more sharply localized than either the total market or agriculture, as may be seen from a comparison of Figure 26 with Figures 2 and 21. More than two-thirds of the employment in manufacturing in the United States in 1950 was in the Northeast, east of the Mississippi and north of the Ohio River. In Figure 26 New Jersey is twice as large as Texas. Connecticut is larger than Missouri, and Rhode Island larger than Maine. The Chicago Metropolitan Area surpasses California. New York and Pennsylvania combined exceed in size all the land west of the Mississippi River, or the entire South. The distribution of the manufacturing areas within each state is depicted on Figure 27.

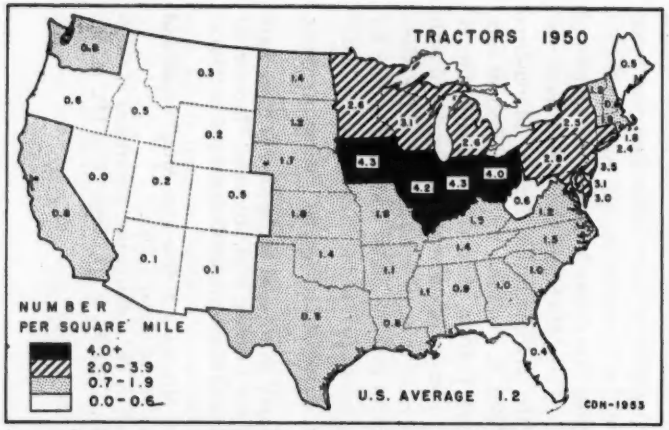
Attention needs to be directed toward manufacturing as the main source of its own materials. An industrialist searching for components for a product may not look directly to the forests, mines, or farms of the country, but rather to other factories. Four-fifths of the industries in the United States utilize materials that have already been processed by other industries.[42] The map of distribution of manufacturing depicts the generalized pattern of the availability of materials, of the treated products of farm, forest, or mine. The automobile industry illustrates clearly the nature of the machinery industries which utilize primarily metals, parts, and subassemblies rather than raw iron ore. G. Ross Henrickson's map of the sources of materials for the Buick automobile factory in Flint, Michigan, shows that these materials come almost entirely from within the Manufacturing Belt.[43] Manuscript maps compiled by Harold M. Mayer and Allen K. Philbrick for the sources of supply for the Studebaker factory in South Bend, Indiana, show similar distribution of sources of materials. A study by Albert L. Hennig of the major industries of Milwaukee revealed that most of their materials came from the western part of the Manufacturing Belt.[44] Bernard H. Schockel found that the major source of supply for the industries of Evansville also lay in the western part of the Manufacturing Belt.[45]

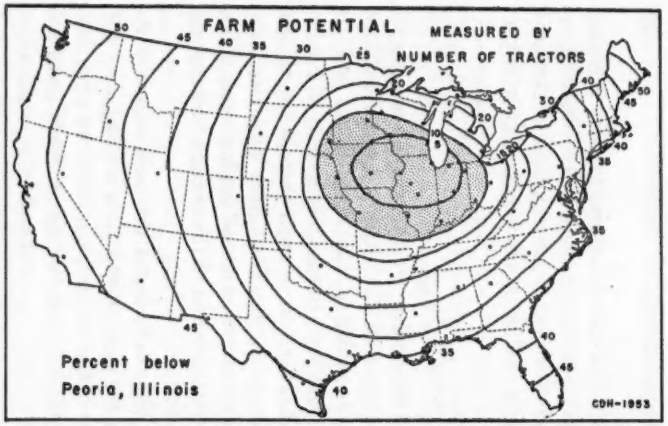
[42] U. S. National Resources Planning Board, *Industrial Location and National Resources.* Washington, 1934. p. 3.

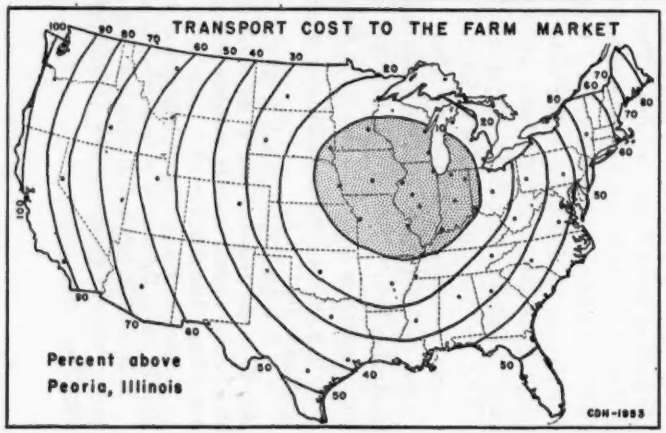
[43] G. Ross Henrickson, *Trends in the Geographic Distribution of Suppliers of Some Basically Important Materials used at the Buick Motor Division, Flint, Michigan,* "Institute for Human Adjustment, Horace H. Rackham School of Graduate Studies, University of Michigan." Ann Arbor, 1951. Fig. 7, p. 47.

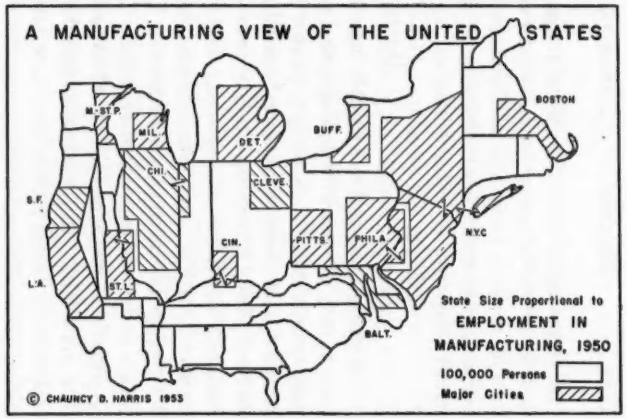
[44] Albert L Hennig, "Metal Industries of the Milwaukee Metropolitan Area," unpublished Master's thesis, Department of Geography, University of Chicago, 1953.

[45] Bernard H. Schockel, *Manufactural Evansville,* Ph.D. dissertation, Department of Geography, University of Chicago, 1947 (lithoprinted), Table 57, p. 211, Table 27, p. 136, and pp. 170–171.


TRACTORS 1950
NUMBER PER SQUARE MILE
4.0+
2.0-3.9
0.7-1.9
0.0-0.6
U.S. AVERAGE 1.2
CDH-1953


FARM POTENTIAL MEASURED BY NUMBER OF TRACTORS
Percent below Peoria, Illinois
CDH-1953


TRANSPORT COST TO THE FARM MARKET
Percent above Peoria, Illinois
CDH-1953


A MANUFACTURING VIEW OF THE UNITED STATES
M-ST.P.
MIL.
CHI.
DET.
BUFF.
BOSTON
CLEVE.
S.F.
CIN.
PITTS.
PHILA.
N.Y.C.
L.A.
ST.L.
BALT.
State Size Proportional to EMPLOYMENT IN MANUFACTURING, 1950
100,000 Persons
Major Cities
© CHAUNCY D. HARRIS 1953

Borrowing a concept from ecology, one might compare the Manufacturing Belt to a climax (formation), in which machinery factories represent the dominant and most characteristic species, but one that thrives best in the presence of a great many other species which prepare the ground. The concepts of ecology in the study of the complex interrelationships within communities might illuminate some of the foundations for the prosperity of plants, industrial as well as botanical.

New York City is the point of highest manufacturing potential as measured by the summation of employment in manufacturing divided by transport cost (Fig. 28). The city itself has the largest manufacturing employment of any city in the country (6 per cent of the total), but even more important is its central position in the manufacturing area along the Eastern Seaboard (Fig. 26). Nearly 30 per cent of the employment in manufacturing in the United States is within 200 miles of New York City.

A belt of high manufacturing potential extends from New York City westward to Chicago (Fig. 28). Outside the environs of New York City, the potential is astonishingly uniform all the way from Altoona, through Pittsburgh, Cleveland, Toledo, and Detroit, to Chicago. The only variation is a slight rise at Cleveland, just as there was in market potential (Figs. 4 and 5). If there were only a single focus of manufacturing within a country one would not expect such a long and uniform belt of high manufacturing potential. We have observed already that for the agricultural market Northern Illinois occupies a central position (Figs. 24 and 25). Chicago lies at the point of nearest approach of the Great Lakes to the agricultural heart of America. At Chicago then is the center for many types of activities oriented toward agricultural markets or toward Midwestern or interior markets (Fig. 10). Between New York City the dominant port, largest city, and center of highest intensity of manufacturing, and Chicago, the center for the agricultural and interior markets, stretches the belt with highest manufacturing potential. The general decline outward from the Manufacturing Belt is interrupted only by a rise in the Los Angeles area.

The point of lowest land transport cost to reach the manufacturing market or manufacturing source of materials lies not on the Eastern Seaboard, but at Cleveland in the interior (Fig. 29). If water transport is taken into account Philadelphia, New York, and Baltimore drop a bit below Cleveland, primarily because of the effect of cheaper transport from these ports to the Pacific Coast (Fig. 30). Manufacturing, unlike farming, has certain peripheral tendencies; these reflect the function of ports in import of raw materials or export of finished products, the historic

FIG. 22. Density of tractors by states, 1950.

FIG. 24. Farm potential as measured by number of tractors in 1950 divided by transport costs from cities indicated by dots. Transport by land only.

FIG. 25. Transport cost by land to the national mechanized farm market, as measured by number of tractors, 1950.

FIG. 26. A manufacturing view of the United States. Areas of states are proportional to the number employed in manufacturing in 1950. Employment in important metropolitan areas is indicated by shading. Some, such as New York City and Chicago, extend into more than one state. The Mountain states have been grouped as one unit, and the Prairie states also.

role of ports as entry ways for ideas, new industries, and industrial labor from across the Atlantic, and the heavy concentrations of urban population in these areas.

RECENT GROWTH OF MANUFACTURING

The growth of manufacturing by counties during the years 1939–1947 as mapped by John Alexander reveals that the greatest absolute increases in this period took place in the large cities on the axis of highest market potential: New York City, Philadelphia, Pittsburgh, Cleveland, and Chicago (Fig. 5) or in cities just north of the axis (Detroit, Milwaukee, and Buffalo) or just south of it (St. Louis, Peoria, Indianapolis, Cincinnati, and Dayton).[46] The cities of the South showed

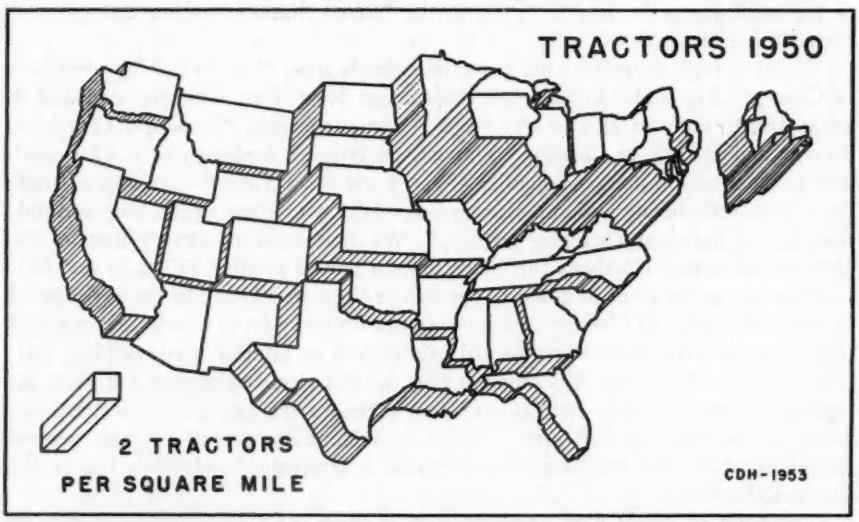


FIG. 23. Tractors 1950 by states. Density per square mile is measured by heights of columns. Number of tractors in each state is proportional to the cubical content of each column. Numbers here represented in three-dimensions are displayed in two dimensions on Figure 21.

only modest development in this period of rapid war-stimulated expansion of the metal and machinery industries.

During the longer period 1914–1947, 60 per cent of the total growth in employment in non-local manufacturing took place in the Manufacturing Belt from New York to Illinois, and another 20 per cent was in the industrial areas of the Southeast and the Pacific Coast (Fig. 31).[47] The remaining 20 per cent was widely scattered. This period spans two world wars, a great depression, and a remarkable develop-

[46] John Alexander, "Industrial Expansion in the United States 1939–1947," *Economic Geography*, XXVIII (1952): 128–142. Map on p. 130.

[47] Cf. A. J. Wright, "Recent Changes in the Concentration of Manufacturing," *Annals of the Association of American Geographers*, XXXV (1945): 144–166.

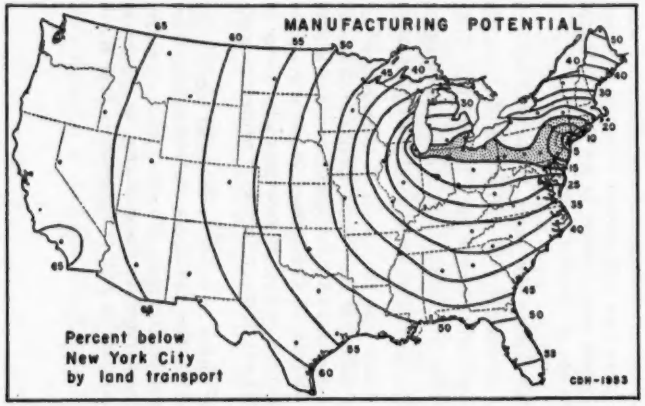
ment of the machinery industries. In order to make the map a more sensitive index of non-local changes, two types of industries have been excluded: ubiquitous industries, such as baking of bread, and material-oriented industries, such as canning or lumbering.[48]

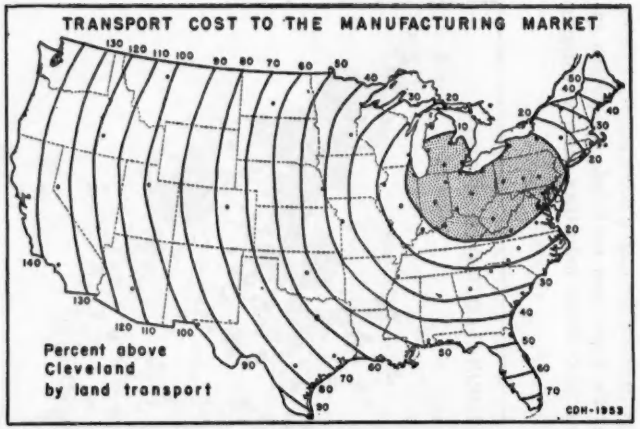
FIG. 27. Counties in the United States with more than 2500 persons employed in manufacturing in 1950. In order not to overemphasize certain large counties in the Western United States, they have been represented by a symbol, the size of a typical county.

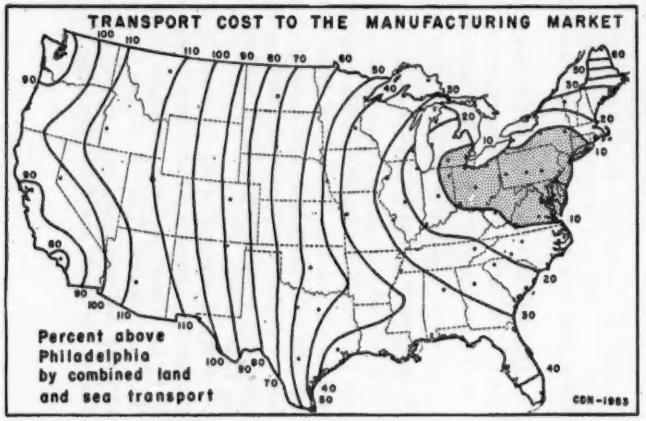
The distribution of industrial development during the years 1914–1947 reflects many factors.[49] In the Manufacturing Belt accessibility to markets and materials and the presence of skilled labor and extensive facilities have been important. That the increase in industry in the western part of the Manufacturing Belt has been twice as great as in the eastern part (Fig. 31) may reflect the lower land transport costs

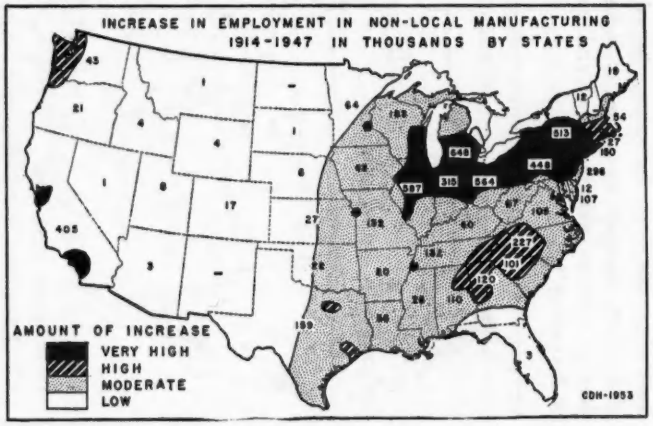
[48] The 1914 calculations were made by Colin Clark from the Census of Manufactures for that year. The 1947 calculations are from: U. S. Bureau of the Census, *Census of Manufactures: 1947*, Vol. III. Washington, 1950. Table 4 for each state. A good example of a state markedly affected by such adjustments is South Dakota, in which about 90 per cent of the workers are in material-oriented industries, such as meat packing or stone products, or else in ubiquitous activities, such as bakery products, bottled soft drinks, millwork, or newspaper printing (*ibid.*, p. 564).

[49] For a summary of the numerous important studies in trends in industrial location see Coleman Woodbury and Frank Cliffe, "Industrial Location and Urban Redevelopment," Part II in *The Future of Cities and Urban Redevelopment* (Coleman Woodbury ed.). Chicago, 1953. pp. 104–288. Table I on page 148 gives employment in manufacturing by regions in 1899 and 1947 and shows three areas of greatest increase in relative importance: East North Central, the South, and the Pacific Coast.


MANUFACTURING POTENTIAL
Percent below
New York City
by land transport
CDH-1953


TRANSPORT COST TO THE MANUFACTURING MARKET
Percent above
Cleveland
by land transport
CDH-1953


TRANSPORT COST TO THE MANUFACTURING MARKET
Percent above
Philadelphia
by combined land
and sea transport
CDH-1953


INCREASE IN EMPLOYMENT IN NON-LOCAL MANUFACTURING
1914-1947 IN THOUSANDS BY STATES
AMOUNT OF INCREASE
VERY HIGH
HIGH
MODERATE
LOW
CDH-1953

to market from this part of the belt (Fig. 7) as well as the growth of the automobile and agricultural machinery industries.[50] In the development of the Southeast, low cost of labor was important in the expansion of the textile industry, but availability of labor and the regional market have become more significant recently. The Pacific Coast, particularly California, has witnessed the creation of market-oriented industries to serve the large but isolated regional market. One curious feature is the zone of slight growth both north and west of the Southeastern manufacturing area. Virginia, West Virginia, and Kentucky on the north and Arkansas and Mississippi on the west have had less growth than adjacent states in any direction (Fig. 31). The comparative poverty of the local markets is a probable factor in Mississippi and Arkansas and a possible one in Kentucky and West Virginia. The location of major regional centers near, but outside, Mississippi and Arkansas may also help to account for the low standing of these two states. Other factors that may have played a role in the slight development of manufacturing in West Virginia are unfavorable terrain, poor rail connections to the north and northeast, and economic lag because of the relatively late development of this part of the coalfield. In New England Connecticut accounts for more than half the total growth. The contrast between Connecticut and the rest of New England rests partly on the structure of industry (metals vs. textiles), but may reflect in part also the advantages of Connecticut's greater accessibility to New York with resulting higher market potentials.

The three areas with little or no increase in manufacturing 1914–1947 are all areas remote from the main national markets and therefore areas of low market potential and high transport cost to market: 1) the Mountain States and the Northern Great Plains, 2) Florida, and 3) northern New England (Fig. 31).

PROBLEMS FOR FURTHER STUDY

Further investigation in some of the aspects of this paper is called for.[51] What effect would the inclusion of Canada have on the maps of market potential and

[50] For statistics and analyses of shifts in relative importance between 1869 and 1935 for 33 industrial areas, mostly within the Manufacturing Belt, see Glenn E. McLaughlin, *Growth of American Manufacturing Areas, A Comparative Analysis with Special Emphasis on Trends in the Pittsburgh District,* "University of Pittsburgh, Bureau of Business Research Monograph

FIG. 28. Manufacturing potential 1950 as measured by the summation of employment in manufacturing divided by distance in transport cost from cities indicated by dots. Land transport only.

FIG. 29. Transport cost to the national manufacturing market as measured by employment in manufacturing. Land transport only.

FIG. 30. Transport cost to the national manufacturing market as measured by employment in manufacturing. Combined land and sea transport.

FIG. 31. Increase in employment in non-local manufacturing 1914–1947 in thousands by states. Excluded from the figures of this map are (1) raw-material oriented industries, such as lumbering and the canning of food and (2) ubiquitous industries localized near local markets, such as baking of bread. Calculations made in cooperation with Colin Clark. Generalized areas of amount of increase are based on distribution of total employment on a county basis.

transportation cost? What is the role of overseas markets and how much would their inclusion alter the balance between coastal and interior points? How nearly does the actual freight-rate structure approximate the generalized transport cost bands used in the calculations of this paper? What has been the role of freight-rate territories with their differing rate structures? How much do the Great Lakes, the Ohio and Mississippi rivers, and the Erie Canal alter the freight-rate structure? The actual marketing areas for specific products and for specific regions need examination. In this connection a few case studies of cities outside the Manufacturing Belt, such as Kansas City, Oklahoma City, Dallas, or Houston, might be instructive in recognizing the types of industries and tributary areas of these centers. Analysis of actual distribution patterns for industrial goods (often through wholesaling centers) might contribute to our understanding of the role of regional centers as ports of entry into regions. We need to apply the methods of cultural anthropology to study manufacturing as a phenomenon which has arisen in centers of invention (earlier mainly in England) and spread by specific routes of communication and imitation to New England and the Middle Atlantic States and thence westward toward interior markets and, to a lesser extent, southward.[52] Research on conditions at the time of the rise of some of the American industries would throw light on the genesis and evolution of the Manufacturing Belt, the existence of which is the dominating factor in present-day industrial location in the United States.

Accepted December 1953

No. 7." Pittsburgh, 1938. For a good survey of factors in the South see McLaughlin and Robock, *op. cit.*

[51] For an account of the contributions of American geographers to the study of manufacturing see Chauncy D. Harris, "The Geography of Manufacturing," Chapter 12 in Preston E. James and Clarence F. Jones (eds.), *American Geography, Inventory and Prospect.* Syracuse, N. Y., 1954, pp. 292–309. For a fuller listing of works see *idem.*, "A Bibliography of the Geography of Manufacturing," Department of Geography, University of Chicago, 1952 (mimeographed).

[52] Carl O. Sauer was a pioneer among American geographers in the recognition of the significance of this concept in geography. Cf. Robert S. Platt, "Die Entwicklung der Kulturgeographie in Amerika," *Erdkunde,* VI (1952): 261 and R. H. Kinvig, "The Geographer as Humanist," *The Advancement of Science,* XXXVIII (September 1953): preprint p. 4.

THE CITY AS A CENTER OF CHANGE: WESTERN EUROPE AND CHINA

RHOADS MURPHEY
University of Washington

EVERY sedentary society has built cities, for even in a subsistence economy essential functions of exchange and of organization (both functions dealing with minds and ideas as much as with goods or with institutions) are most conveniently performed in a central location on behalf of a wider countryside. The industrial revolution has emphasized the economic advantages of concentration and centrality. But is it true to say that change, revolutionary change, has found an advantage in urbanization; in concentration and in numbers? The city has instigated or led most of the great changes in Western society, and has been the center of its violent and non-violent revolutions. In western Europe the city has been the base of an independent entrepreneur group which has successfully challenged and broken the authority of the traditional order. In China, while cities with the same universal economic functions arose, they tended until recently to have the opposite effect on the pattern of change. China has consistently reasserted itself as a single political unit, but it is otherwise the appropriate qualitative and quantitative counterpart of Europe, and provides a reasonable basis for comparison. China and Europe have been the two great poles of world civilizaiton, and an examination of the different roles which their cities played may help to elucidate other differences between them.

The following generalized and capsulized discussion aims only to suggest this difference, as an example of what might be made of an approach to the study of society through an analysis of the city's role in the process of change.[1] By cutting a familiar pie in another way we may arrive at useful insights. In doing so in the short space of an article the writer realizes that he must raise or beg more questions than he

[1] This is not a new idea. Other and older applications of it would include Giovanni Botero, *A Treatise Concerning the Causes of the Magnificance and Greatness of Cities,* transl. Robert Peterson (London, 1606); Georg Simmel, *Die Grosstadt und das Geistesleben* (1900); Theodore Peterman (ed.), *Die Grosstadt* (1903); N. S. B. Gras, "The Development of the Metropolitan Economy in Europe and America," *American Historical Review,* XXVII (1921–22); Michael Rostovtzeff, "Cities in the Ancient World," in *Urban Land Economics,* ed., Richard Ely, (1922); E. W. Burgess, et. al., *The City* (1925); Henri Pirenne, *Medieval Cities; Their Origins and the Revival of Trade* (1925); Max Weber, *Wirtschaft und Gesellschaft* (1925), Part I, Chap. 8; Louis Wirth, "Urbanism as a Way of Life," *American Journal of Sociology,* XLIV (1938); A. M. Schlesinger, "The City in American History," *Mississippi Valley Historical Review,* XXVII (1940); William Diamond, "On the Dangers of an Urban Interpretation of History," Chap. 4 in *Historiography and Urbanization,* ed. E. F. Goldman (1941); Sylvia Thrupp, *The Merchant Class of Medieval London* (1948); Pierre George, *La Ville: le fait urbain a travers la monde* (1952).

answers, and may in particular be guilty of oversimplification or distortion. But the virtue of such an attempt may lie in its disturbing or even irritating nature; it aims less to prove than to provoke. To quote from Karl Marx with this in mind, ". . . the whole economical history of society is summed up in the movement of this . . . separation between town and country."[2] In distinguishing between European and Chinese civilization, we must of course assume a complex multiplicity of causes, many of which may elude us, and many of which may have little or nothing to do with geography,. The distinctions and the arguments which follow do not imply that this basic fact is disregarded, but they pursue the matter from a point of view which has frequently been neglected and which may be suggestive of important factors.

The cities of western Europe have been, at least since the high middle ages, centers of intellectual ferment; of economic change; and thus, in time, of opposition to the central authority. They became rebels in nearly every aspect of their institutional life. It was trade (and to a somewhat lesser extent specialized manufacturing) which made them strong enough to maintain their challenge to the established order. Their spirit of ferment was the spirit of a new group, urban merchant-manufacturers, which could operate from a base large and rich enough to establish increasingly its own rules. This setting tended to ensure that the universities, which grew up in cities originally for convenience and centrality, would frequently nourish skepticism, heresy, and freedom of enquiry.[3] Even where they did not overtly do so, the concentration of literacy and learning in the cities was a stimulus to dissent.

Most of the cities which rose out of the cultural and social chaos following the destruction of Roman unity and preceding the development of a new national unity grew in answer to new conditions, for northwest Europe was ideally situated for trade. Most of them were in their origins much older than this, and had begun as administrative, military, or ecclesiastical centers. But a score of major rivers, navigable and free from floods, silting, or ice throughout the year in this mild maritime climate, led across the great European plain to the open sea; the peninsular, indented nature of the coast critically heightened mobility. The invitation which this presented to inter-European trade furthered the ascendancy of the commercial function. The shift of commerce and associated urbanism from the Mediterranean to northwest Europe seems to have begun before the Age of the Discoveries, notably in the Hansa towns and in Flanders. This may be in part a reflection of the mobility inherent in the lands around the Baltic and North Seas, once they had learned from the Mediterranean the lessons of commerce and absorbed the civilizing influences of this earlier developed area. In any case, these northern cities came to be dominated by trader-manufacturers. Trade was a heady diet, and enabled urban

[2] Karl Marx, *Capital*, edition of 1903 (Chicago): Vol. I, p. 387.

[3] Oxford and Cambridge, as rural universities, help to enforce this point. They were proverbially conservative, their most important job the training of students for the ministry. Spain's distinction from western Europe on this and nearly every other point raised is merely a reminder of the old aphorism "Africa begins at the Pyrenees."

merchants to command cities which had originally been administrative creations. While the cities did not alone destroy feudalism, they owed much of their prosperity and independence to its decline: freer trade, wider exchange, and failing power of the landed mobility. And their very growth as rival power bases accelerated the collapse of the old feudal order.

As the growth of national unity progressed, under the institutional and emotional leadership of monarchy, an alliance of convenience between king and city arose which met the crown's demands for funds and the city's demand for representation. Urban merchants had the money to support the king in his foreign wars and in his struggle with the divisive domestic ambitions of the nobility and the church. In return the city received an increasing voice in the affairs of state, through representation in parliaments, and indirectly through the making of policy in which the throne was obliged to follow. But while this alliance of revenue in exchange for concessions was one of mutual interest, its ultimate result was the strengthening of the urban commercial sector until it overthrew or emasculated the monarchy, and with it the traditional order as a whole. Having helped the king to power over the nobility, the city achieved a *modus vivendi* with him which left it in control of the affairs vital to it. As a current reminder of the development of urban independence, "the city" of London retains its originally hard-won privilege of excluding the reigning monarch, who is also excluded from the House of Commons, in part the city's creation and in part its weapon. To a certain extent the king, and even the nobility, were willing to go along with the process of economic change instigated by the city since they profited from it as the principal source of wealth in which they were often investors as well as tax collectors. But the new values which the city emphasized, and their institutional expression, were in direct conflict with the traditional society based on land; the city repeatedly bred overt revolutionary movements designed to establish its new order as the national way of life.

As centers of trade, the cities were free of the land and of its social and political limitations embodied in the institutions of post-Roman society. They developed their own law which was in differing degrees independent of the traditional, rural law. Their institutions were self-made, and they were not beholden to the traditional system which they challenged. The companies and corporations which the merchants organized went far beyond the scope of guilds in their successful attempt to order most of the social and economic fabric (instead of being limited to a trade-union function, as the guilds of China predominantly were). Traditional guilds were overlaid with new merchant organizations, or were clothed with new functions and powers, although some of the older guilds remained as conservative or retarding influences. The economic institutions which arose concurrently were also new-made sources of strength: banking, letters of credit, private property, interest, speculation and investment, representing needs and ideas which were almost wholly foreign to the traditional society of the countryside, and which were the accompaniment of an ever-widening trade. For the invitation to commercial expansion overseas was as strong in Europe's geography as the earlier invitation to trade among the

lands surrounding the Baltic, Mediterranean, and North Seas. A leading agent of this process was necessarily the city, where trade flowed through break-in-bulk points such as the mouths of the Rhine or the English ports facing the Channel. Merchant corporations for overseas trade became the strongest and most progressive, or revolutionary, of the city's agents. Interestingly, the original charter of the British East India Company stated that "gentlemen" (by which was meant the landed gentry) "shall be excluded" from membership.

The city was the natural center of political change as it had been of economic change. The growth of modern Europe may be regarded as the steady progress of a new class of urban traders and manufacturers toward a position of control in a society and economy which their own enterprise had largely created. It was they who had realized the potential of Europe's location for world trade, and they who had developed and applied the technological and economic tools which made Europe the center of the world. The destruction of the old pattern was implicit in this process, and also implicit was the revolutionary expression, by the cities, of their claim to political power. City-country alliances were formed, and the dissident groups from the country often bore the brunt of the effort, since they were the more numerous, as well as sharing in the spoils. But the city was in the van, and even diverted or perverted rural dissent and rural force to its own ends; leadership and money were frequently more decisive than numbers. It is of course true that at least in England this city-country alliance left and perhaps still leaves the landed gentry with prestige and thus with considerable power, while it left wealth with the urbanites. Characteristically this wealth was used to acquire land and gentry status. This balance of advantage was particularly pertinent in the matter of parliamentary representation.

Revolutionary changes are nearly always the work of an alliance of groups, but the history of modern Europe is suggestive of the city's key role, despite the recurrent blurring of city-country distinctions. The first great modern revolution, in seventeenth century England, was the work of a city-country alliance, but London was mainly Puritan, and the outcome might be regarded as the victory of urban merchants and their country confreres over the traditional authoritarian alliance of cavalier and peasant based on the land.[4] Two centuries later Manchester and Birmingham had joined London in the final stages of the contest between urban "radicalism" and country "conservatism," epitomized in the struggle over the Corn Laws, the Reform Bills, free trade, and the Manchester School. By this time cotton textiles had well supplanted woolen textiles as the chief manufacturing industry; since it came relatively late it was not greatly hampered by guild restrictions, as wool had been; it established itself in Manchester, which as a then unincorporated town lacked formalized controls. It may irritate many readers as a loose generalization, but still seems worth stating for argument, that representative government and the

[4] Generalization on matters such as this is particularly hazardous. A recent study has cast serious doubt on these commonly accepted alignments: see D. H. Pennington and Douglas Brunton, *Members of the Long Parliament* (London, 1953).

industrial revolution, perhaps modern Europe's two most significant products, were created by the city. The Low Countries provide as good an illustration of this as does England.

In France the picture was less clear since urban merchant-manufacturers were less prominent in the national economy. Even so, it was Paris which created and carried the revolution. Paris used peasant distress and rebellion, but was never dethroned by it. One may say that Paris later destroyed Charles X and Louis Philippe. By this time, however, the Napoleonic land reform had given the peasant a stake in the status quo and helped to keep him a conservative counter-influence to the city, after his revolutionary ardour of the 1790's had served its purpose and cooled. Thus, in part, is derived the country's role in the destruction of the Second Republic and the Paris Commune, "radical city movements." Across the Rhine these distinctions become increasingly blurred, as for example in the Peasant War in early Reformation Swabia and Franconia. In eastern Europe it is difficult to draw distinctions between city and country, or to find an independent urban-based group living on trade and challenging the existing order. Nevertheless even in twentieth century Russia, while the Soviet revolution was in part carried by peasant groups, leadership remained in the urban intellectual group which had instigated the change.

In northwest Europe, which is our concern here, the city has been a consistent seat of radicalism. This is not to overlook the recurrent Jacqueries which in every society have been the desperate recourse of an oppressed peasantry. But in the West these have often been closer to reaction than to revolution—the peasants were demanding the restoration of the status quo ante, not the establishment of a new order. Where they did attack the old order it was characteristically on specific points, such as Wat Tyler's demand in fourteenth century England for the disendowment of the church. The same pattern is apparent in rural opposition in America, in uprisings like the Whiskey Rebellion or in political parties like the Populists. The removal of abuses does not necessarily mean revolutionary change, despite the violence or the "levelling" sentiments which usually characterized rural dissidence.

In China, while the peasant and the countryside were in some respects like the West, the city's role was fundamentally different. Chinese cities were administrative centers. With few exceptions this function dominated their lives whatever their other bases in trade or manufacturing. Their remarkably consistent, uniform plan, square or rectangular walls surrounding a great cross with gates at each of the four arms, suggests their common administrative creation and their continued expression of this function. Local defensive terrain, such as at Chungking, occasionally made this common plan unsuitable, but the stamp of governmental uniformity is nonetheless apparent. This was true for cities which had originally risen as trade centers, or which became more important commercially than they were administratively. It is possible to find a clear separation in many provinces between administrative and commercial cities, where the capital is not the most important commercial base:

Chungking and Chengtu in Szechuan, Chengchow and Kaifeng in Honan, Hankow and Wuchang in Hupeh, Hsiangtan and Changsha in Hunan, Soochow and Nanking in Kiangsu, Wuhu and Anking in Anhwei, Tientsin and Peking in Hopeh, and other less clear cases.[5] But despite this degree of functional specificity, little urban independence or urban-based revolutionary change appeared until the traditional fabric was rent by the growth of Western-inspired treaty-ports. Even in the exceptional cases where trade or manufacturing was the sole or predominant basis of the city: Chingtechen, the site of the Imperial Potteries, or Canton, the consistent focus of foregin trade, there never developed a merchant-controlled urban base free in any significant sense of the traditional state order.

A case in point is Shanghai. Long before the city became a treaty-port under foreign domination, it was the leading commercial hub of the Yangtze Valley and may even have exceeded Canton in the volume of its trade. A British visitor in 1832 maintained that it did, and his count of junk traffic suggests that Shanghai was then among the leading ports of the world.[6] It nevertheless remained well down on the list of delta cities by size despite its lion's share of the trade. Another British visitor in 1843, the year in which Shanghai was opened to foreign trade as a treaty-port, estimated its population at 270,000, Hangchow at one million, Soochow, Ningpo, and Nanking at half a million each, and six other delta cities at figures equal to or greater than Shanghai's.[7] Shanghai has never performed any administrative functions outside its own metropolitan limits, and it may be for this reason that it did not dominate the delta until Western entrepreneurs largely took over its development. In bureaucratic China, trade alone could not rival administration as an urban foundation. Outstanding locations for trade, such as Hankow (or Shanghai), as advantageous as Amsterdam or London, were frequently not put to full use until European traders built major cities there. Wuchang, opposite the mouth of the Han, was an almost exclusively administrative city before 1850, while Hankow itself was only a moderate sized town.

Large cities seem to have been proportionately more numerous in China than in Europe until the nineteenth century, and until the eighteenth century urbanism may have been higher. Perhaps a quarter or more of the population lived in towns and cities of more than 2500 population, and perhaps 10 or 15 per cent in cities over 10,000. The big cities of the East as a whole were huge by European standards; this was a consistent feature of what has been called "Oriental society."[8] In China most cities or towns of 5,000 or more had well-defined commercial or manufacturing districts, and special areas for each important enterprise: banking, metal goods, food

[5] Compare for instance the original development of London as two cities separated by open country, Westminster as the administrative center, and "the city" as the center of business.

[6] Rhoads Murphey, *Shanghai: Key to Modern China* (Cambridge, Mass., 1953): p. 59.

[7] Robert Fortune, *A Journey to the Tea Countries of China and India* (London, 1852), Vol. I, pp. 97–98.

[8] See especially K. A. Wittvogel, *Oriental Society and Oriental Despotism* (forthcoming). For example, ancient Alexandria had a population of about one million in a country (Egypt) with a total population of only seven million.

markets, textiles, woodwork, and so on. This pattern remains in most contemporary Chinese cities. But the cities were not decisive centers of change in a commercialized economy. They served as imperial or provincial capitals, seats for garrison troops, and residences for governors, viceroys, and the ubiquitous cloud of officials and quasi-officials with their "service-providers." Their business was administration, and exploitation, of the countryside. Marco Polo, in describing the magnificence of Peking, accounts for it as follows:

> . . . and this happens because everyone from everywhere brings there for the lord who lives there and for his court and for the city which is so great and for the ladies and barons and knights of whom there are so many and for the great abundance of the multitude of the people of the armies of the lord, which stay round about as well for the court as for the city, and of other people who come there by reason of the court which the great lord holds there, and for one and for another . . . and because the city is in too good a position and in the middle of many provinces.[9]

Here is a clear picture of a city based on administration from a central location, where trade flows in largely in response to the existing structure of officials, troops, court, hangers-on, and the host of people necessary to support them, from secretaries and servants to bakers and dancers. Six hundred years later at the end of the nineteenth century European travellers in China reported the same phenomenon, on a smaller regional scale: large cities whose sole function appeared to be administration, or important trading cities at key locations which were nevertheless dominated by officials and the magistrate's *yamen* (office). Thus Archibald Little, describing the city of Kweichowfu in Szechuan where the manufacture of salt brine and coal dust balls, and trade on the Yangtze River, were the apparent sources of its prosperity, writes that the city was a main station for the collection of *likin* (internal customs tax) and "the town is studded with the numerous mansions of the wealthy officials and their dependents."[10] With the opening of Chungking as a treaty-port, *likin* was collected at Kweichowfu only on local hauls and the city rapidly decayed despite its apparently strong economic base in manufacturing and trade.

The trade process appears to have lacked the dynamic quality by means of which Europe's cities rose to power. Pre-eighteenth century China had a trade as great as or greater than pre-eighteenth century Europe, but Europe's subsquent commercial expansion left China far behind. Why this happened, and why China never produced the revolutionary economic and political changes which re-made Europe into an arbiter for the rest of the world is a vital question. An analysis of the city's role may help to suggest some relevant factors. Why was the Chinese city not a European-style center of change?

China is geographically isolated by a formidable assemblage of barriers. To landward lies the greatest mountain mass in the world, with its extensions from the Pamir Knot, reinforced on the south by rainforests and spectacular river gorges, on the north by the barren wastes of Siberia, and on the west and northwest by a

[9] A. C. Moule and Paul Pelliot, *Marco Polo, the Description of the World,* (London, 1939), Vol. I, pp. 236–237.

[10] Archibald Little, *Through the Yangtze Gorges* (London, 1898), pp. 87 ff.

vast sweep of desert. Seaward a coast deficient in harbours faces a huge and until recently commercially underdeveloped ocean, by European standards. Chinese trade with Japan was at several periods considerable, and with southeast Asia even larger, but it did not approach eighteenth or nineteenth century European levels. It tended to be characterized by luxury goods, strategic goods (such as copper for coinage), or specialties such as Chinese porcelain. With these exceptions, especially the highly developed and diversified trade between southeast coastal China,[11] and southeast Asia, China did not greatly extend herself commercially, and was for the most part content to send specialized goods, like silk, to the rest of the world through middlemen intermediaries: the Arabs by sea and the Turkish peoples of central Asia by land. Significantly, the largest concerted Chinese attempt in foreign trade was an imperial government project (the famous Ming expeditions of the fifteenth century), which lasted only some 30 years and apparently found no solid base in the Chinese economy or in its merchant group.

Internally, trade moved largely on the great river systems, running fortunately east and west, but there was no such close interconnection between these river basins as in Europe, by sea or across plains. Physically China is built on a grander scale, but the landscape presents no such invitation to exchange as has sparked the development of Europe. Europe is multi-peninsular, each peninsula tending toward economic distinctiveness and political independence, but joined by cheap sea and river routes. This plethora of complementary areas and their transport links magnified the basis and the means of exchange. Although its early trade development was not larger than China's, by the middle of the eighteenth century commercial expansion overseas had joined and accelerated commercialization at home, and Europe stood in a class by itself. The cities of western Europe were both the creators and inheritors of this development. But in China the cities remained centers of the unitary national state and of the traditional order rather than its attackers, epitomes of the status quo. As direct links in the official hierarchy, they were the props of the empire. The universities were urban, for convenience as in Europe, but they stimulated no dissent. Their accepted function was to train scholars who could staff the imperial civil service, and they fed their graduates into the imperial examination system. This, and the better economic and social position of scholars generally in China than in Europe, encouraged the universities and the literati to support the status quo; European intellectuals may have taken a vow of poverty, but they remained a dissident or discontented group.

Physically, China lacked Europe's outstanding advantages for trade, and on the other hand presented a base for highly productive agriculture, through irrigation. Wittvogel's revealing work on the organic connection between the need for mass organized water control and the growth of a monolithic bureaucratic state in China

[11] Southeast China has many fine harbours and overseas trade has been prominent there for centuries. But it is effectively isolated from the main body of China by mountains, including those which help to make its harbours, and trade there has thus made much less impact on the rest of the country. The distinctiveness of the southeast is also clear in its many regional ethnic and linguistic elements.

lends insight into the origins and pattern of the institutional structure.[12] With China's environmental advantages, water control made agriculture the massive core of the economy, and at the same time left the bureaucracy in a position of ramified command. It was not possible for urban merchants to win independence from this system. They had less economic leverage than the rising European merchants because, with the preponderant position of agriculture, they never occupied proportionately as large a place in the economy.

The state of course did its part to prevent the development of a rival group, and by taxation, requisition, and monopoly ensured that the merchants would be kept relatively impotent. This was a job which European states and monarchs, though equally determined, failed to accomplish; their merchants were in a stronger position, and the state was weaker: it was merely *primus inter pares*. Land hunger in China, as a reflection of a population too large for the available arable land (increasingly serious during the past 200 years, but even in Han times worse than in most other parts of the world, including Europe), also acted to restrict commercial development, since it meant high land rents. Capital could almost always be invested with greater profit and safety in land, or in rural loans, than in productive or capital-generating enterprises outside the agrarian sphere.

Where extra-agricultural opportunities for investment did exist, the individual entrepreneur was at the mercy of the bureaucratic state. Many of the major trade goods were government monopolies. Elsewhere the essentially Western concepts of private property and due process of law, in a word, of the entrepreneur, were lacking in a society dominated by agriculture and officials. Extortion, forced levies, confiscation, and simple financial failure as the result of arbitrary government policies were the daily risk of the merchant. Some individuals did indeed become very rich, for example the famous *hong* merchants of Canton, but their wealth came necessarily through official connection: by possession of gentry status, by office holding or official favour, or by trading as part of a government monopoly (such as foreign trade under the Canton system and at most other periods was). Even so their gains were never secure. The greatest and richest of the *hong* merchants died in poverty, having lost official favour. While this also happened to many of the pre-eighteenth century European capitalists, it did not prevent the survival and growth of individual capitalist families or firms or of a moneyed group. The famous Ch'ing dynasty billionaire Ho Shen, said to have been worth the equivalent of nearly a billion and a half U. S. dollars, was not a merchant at all, but a favourite minister of the emperor Ch'ien Lung, which demonstrates the real source of wealth in traditional China. Yet he too died in poverty and disgrace (by suicide in place of a suspended death sentence in 1799) at the hands of Ch'ien Lung's successor.

In China merchant-capitalists did not use their money to establish their inde-

[12] K. A. Wittvogel, "Foundations and Stages of Chinese Economic History," *Zeitschrift für Socialforschung*, IV (1935): 26–58. *ibid.*, "Die Theorie der Orientalischen Gesellschaft," *loc. cit.*, VII (1938): 90–123. (This article clearly states the administrative basis of the Chinese city, and discusses the reasons and implications.) *ibid.*, *Wirtschaft und Gesellschaft Chinas* (Leipsig, 1931). *ibid.*, *Oriental Society and Oriental Despotism*, (forthcoming).

pendence, as did the merchants of London or Antwerp, or to stimulate the growth of a new economic pattern. Unfortunately for the Chinese merchants, the imperial revenue was at most periods derived largely from the land tax and from the government trade monopolies. Agriculture was proportionately more productive than in Europe, and revenue from trade less necessary. Peking thus did not need the merchants as the king had needed them in Europe to finance the ascendancy of the national state, to pay for its wars with rival states, or to meet its normal bills. No concessions were necessary; the merchants could be squeezed dry, and were, with no harm to the state. The commanding position of the bureaucracy, and the fact of the bureaucratic state, are perhaps explainable by a similar process of default. Merchants were necessary or useful to perform essential (and, to the state, profitable) commercial functions; they were tolerated, but kept under strict control, and this was simpler and cheaper than for the state to manage all commercial dealings itself.[13]

But the merchants were also identified with the state as well as being stifled by it. Their numbers were recruited largely from the gentry class, who had the capital and the official connections essential to commercial success. Gentry merchants worked willingly with gentry officials in the management of the state monopolies, including foreign trade. Outside the monopolies, the same partnership operated, as a matter of mutual interest. In addition, most gentry members, whether or not they were engaged in trade, also performed other semi-official functions, comparable in some degree to the British landed gentry. These "services" represented a considerable part of their income; they were not likely to attack the system which nourished them. In a more general sense, the tradition of revolt in this hierarchical society did not include the re-ordering of social or economic groups, but concentrated on the removal of bad government. Individual or group improvement was not to be won by destroying the fabric, but by making optimum use of one's position within it.

Finally, China had maintained since Han times and with few breaks a remarkable degree of unity[14] and a central power which no single European state achieved until quite late in its modern development. In China even towns of the *chen* (market town) rank (population c. 3000–5000) were seats of garrison troops, whatever their prominence in trade. In Europe in the course of the crown's contest with the nobles, and of the international rivalries which also developed among the plethora of separate national states, urban merchants found an opportunity which contrasted sharply with the rooted monolithic nature of the Chinese state.

The cities of China were consequently microcosms of the empire, not deviants. They were not backwaters, for necessarily learning, art, and the trappings of cosmop-

[13] K. A. Wittvogel in his forthcoming *Oriental Society and Oriental Despotism* speaks of this arrangement as based on "the law of diminishing administrative returns."

[14] The persistent unity of China despite wide regional diversity is something of a puzzle, but may be related to China's dramatic isolation and to the unitary rather than peninsular nature of her continental base.

olis were concentrated in them. Yet, each was a symbol of the imperial system, operating not only under the direct thumb of Peking, but according to its precepts. Obvious considerations of convenience made them central places, market towns, transport termini or break-in-bulk points, and exchange centers of varying degrees of sophistication. But these universal urban functions do not automatically bring with them the character of rebellion or innovation which we have rightly come to associate with cities in the West. The main distinction of the Chinese city was concentration, as the node of the traditional society and as its power base. Imperial authority filtered down more slowly into the countryside, becoming more dilute with every level. Every government with ambitions of central power attempted to control the peasant. In a largely pre-commercial and pre-industrial society of a basically molecular character, this could never be perfect control. China lacked not only the tools of control for its huge area, such as communications and literacy, but the bond of common interest and attitude which a completely commercialized economy tends to create, often by sublimating or suppressing conflicting interests. In the absence of such tools or conditions to implement rural control in China, the importance of the city as a center of political and military power on the side of authority was magnified.

Change in China, as elsewhere, has been the work of a city-country alliance, with the leadership coming usually from the gentry based in cities or towns. But the origins of dissent and the main force of attacks on the status quo have been far less urban in China than in the West. While the rebellions were in many cases closer to the usually unsuccessful Jacqueries of the West than to the really revolutionary changes generated in Western cities, they were the predominant agents of what change did take place. They were successful where their Western analogues failed because there was no more potent agent of change, no other group (if we except the several nomadic invasions and conquests) and no other economic base by which change might even superficially be forced. The similarity with the Jacqueries lies in the fact that Chinese rebellions rarely challenged the basic nature of the existing order, but only its administration. The new dynasty which resulted might mean new blood, but seldom new institutions.

Given a largely closed, agrarian system, it is understandable that each dynasty, as it lost its momentum, lacked the means of maintaining a high productivity and effective distribution as population increased, and that it eventually declined into corruption. This was especially so in the rural sphere, easy prey to tax and rent manipulation (and the source of most of the national revenue and income), but marginal enough to be sensitive to oppression. At the same time, the lack of large extra-agricultural economic bases for an independent group prevented the growth of new ideas or new institutions to challenge the old, even while the old lay in ruins. The city-country alliance which in Europe made revolution made only a change of administration in China. The city was too dependent on the traditional order to attempt its destruction.

The accelerated impact of the West on China during the nineteenth century has

by the twentieth century set in train profound changes, and it is natural to find that these are reflected also in the city's role. The Kuo Min Tang was a largely urban-based movement, and though its revolutionary aspects became less and less prominent under the more compelling problems of security against Communists and Japanese, it was far more than a change of administration. It was in fact the political vehicle of a new group, nurtured not only in Western thought, but in the essentially Western milieu of the treaty-ports. Negatively also the cities have made a new impression. The present Communist regime had prominent rural roots, and came to power with an announced resentment and distrust of cities, calling them the centers of reaction (and also of degeneracy, softness, and vice), though its venom was directed particularly against the foreign-created treaty-ports.

It was basically the impact of the West, including the Soviet Union, which ensured that this latest of rebellions would for the first time successfully destroy the existing fabric. In the treaty-ports thmselves development had been too brief, and too much limited by the inertia of the agrarian economy, to produce an effective base for change to rival Communism in its originally rural base. Nevertheless these urban centers, many of them new as large cities dependent on trade, played much the same role as the cities of late medieval Europe. They were rebels against the traditional order because for the first time in the history of China they provided opportunity for the merchant. Money could not only be made, but invested, in trade or manufacturing, with safety, profit, and prestige. Private property, and all of the values of R. H. Tawney's "Acquisitive Society" had been enthroned in the treaty-ports by the West, and to the Chinese businessman Shanghai or Tientsin were all that traditional China was not. He was prepared to work for the establishment of a government and society which would make a respectable place for a commercial industrial bourgeoisie, based, as the term implies, in cities.

This new group, shaped by the West, largely created the Kuo Min Tang. They formed an alliance with some of the landed gentry, for example Chiang Kai-shek, who was both landed and bourgeois, but they were never in any sense a peasant party, and their ties with the land were feeble. While they answered, or promised to answer, many of the needs of the new class of treaty-port Chinese, and kept peace with the gentry, they did not seriously attempt to answer the questions and strivings of the Peking intellectuals, nor the more compelling needs of the peasants. Communism ultimately rode to power in part as a crusade against the "merchant capitalists" of Shanghai on the one hand and the Western-inspired intellectuals of Peking on the other.[15]

[15] As the capital and as the seat of the largest Western-founded universities, Peking was a center of intellectual ferment by the end of the nineteenth century since intellectual contact with the West was easiest there. Traditional, imperial China had by then lost enough prestige that dissension flourished in Peking itself. While many of the intellectuals rejected China's traditional civilization in whole or in part, their struggles in this scholar's community made little impact on the nation as a whole. The Chinese Communist Party was founded in Peking in 1921, but largely deserted it for a rural base. Student and intellectual ferment in Peking

To be sure, the Chinese Communist Party and its leaders are urban-trained Marxists operating intellectually and practically in an urban framework, and dedicated to an industrialization program which necessarily centers in the cities. Their political control also depends substantially on their control of city populations and city enterprises. Insofar as they thus push the city toward the middle of the stage as a recognized base at least for economic and technological change, they continue the about-face in the city's role which the Western impact began in the treaty-ports. In any case, active urban agency for change is a recent phenomenon in China, perhaps one may say a direct transmittal from the West.

This analysis, in attempting to particularize the city's role in the two great centers of world civilization, has necessarily dealt with institutions as much as with place. The urban differences were expressions of distinct societies. It was broadly speaking the bureaucratic state in China which stifled the growth of European-type cities despite the volume of trade or the regional specialization of commerce and manufacturing which existed. In Europe, too, wherever bureaucratic and/or persistently authoritarian governments ruled, commercialization and industrialization were late and/or little, and the urban-based entrepreneur usually exerted small influence. Some other common ground may exist between these bureaucracies, and the suggestion that physical conditions required or invited central control, and that geographic factors helped to minimize the opportunity of the merchant, are perhaps as applicable to eastern Europe, or to Spain, as to China. The imprint of Roman Law and of Mediterranean urban traditions may also help to account for the east-west distinction in Europe. In any case, maritime western Europe followed a course whose urban direction lay at the root of its wealth, its power, and its distinctiveness.

Sir George Sansom, in a characteristic series of lectures given at Tokyo University in 1950 and published in 1951 under the title *Japan in World History*, typifies the modern European attitude and contrasts it with the Tokugawa Japanese by quoting as follows from Alexander Pope's "Windsor Forest," written about 1712:

> The time shall come when free as seas or wind
> Unbounded Thames shall flow for all mankind,
> Whole nations enter with each flowing tide
> And seas but join the regions they divide.

This is so revealingly and typically English, and so untypically Chinese, because it shows the world through the eyes of the London merchant. Ironically, merchant towns of a European type had begun to develop in Japan by the sixteenth century around the Inland Sea (perhaps an oriental Mediterranean?), including self-governing Sakai, living on the trade with China and southeast Asia. Sakai, with its own army and its council of merchants, was so close to the European pattern that contemporary Jesuit observers compared it with Venice. This promising development was crushed, despite its apparently strong economic base, by the feudal re-

was revolutionary in thought, but ineffective in action. Both the treaty-ports and the countryside proved in the end to be much more effective bases for change or for rebellion.

vival of the Togukawa and its superior armies reacting to the political threat which they felt was posed by the existence of even quasi-independent merchant cities. Here we may perhaps see an expression of Japan's insularity and strategic commercial location, and perhaps *inter alia* of the weight of influence from China. The latter was earlier expressed in the great period of Japanese borrowing from T'ang China when Nara, Japan's first real city, was built on the Yamato plain as a smaller scale copy of Ch'ang An, the T'ang capital. Nara omitted Ch'ang An's massive walls, and walled towns as such have never existed in Japan at any period, one reflection of a basically different set of geographic and social conditions.

But our purpose here has been only to suggest. The city has been a center of change in western Europe, while it has been the reverse in traditional China, despite the broad similarity in urban economic functions in both areas. Urban character and urban roles may be useful indicators of the nature and dynamics of the diverse entities of society.

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ALLUVIAL MORPHOLOGY OF ANATOLIAN RIVERS

RICHARD J. RUSSELL*

Louisiana State University

ANATOLIA has been described as resembling a hand with somewhat spread fingers pointing toward the Aegean Sea. The fingers of the fanciful hand are ridges, between grabens created by faulting that continues actively to the present day. Tectonic agencies determine the westward trends of the principal valleys in both western and northern Anatolia, but toward the southeast the great sweep of the Toros and adjacent ranges forces most rivers to flow southward into the Mediterranean, or southwestward into the Gulf of Iskenderun.

ALLUVIAL DROWNING

Though the gross features of the topography are structural in origin, one of the most impressive characteristics of Anatolian rivers is alluvial drowning along their lower courses. Alluviation which has taken place during the last general rise of sea level accounts for flat flood plains that stand in abrupt topographic unconformity with the bedrock faces of adjacent valley walls. Toward coasts, where flood plains become deltas, isolated hills commonly jut above the alluvium which surrounds them on all sides. These are the tops of once much higher eminences which belonged to a much rougher topography that was created by denudation when sea level stood low, during glacial stages of the Pleistocene.

The effects of alluvial drowning are displayed magnificently in the basin of the Sakarya River some eighty miles east of Istanbul. The top of the Recent alluvial fill forms an extensive plain in the vicinity of Adapazari, about twenty-five miles inland from the Black Sea (Fig. 1). The alluvium has accumulated so rapidly that it dams a portion of the undulating graben which extends eastward from the Gulf of Izmit, impouding the waters of Sapanca Lake.

The eastern shore of Sapanca is a peculiar delta, an advancing alluvial flat which grows with continued accumulation of the Adapazari Plain alluvium. The delta front builds into the lake at times of flood, when overflow from the Sakarya and other streams pours into Sapanca Basin. But the principal stream of the delta, the Çark, actually serves as the outlet of the lake during most of the year. This river leaves the lake to turn northward, keeping to the west of Adapazari and winding between alluvially drowned hills for some twenty miles before becoming tributary to the Sakarya.

A hesitant and uncertain drainage in the Adapazari Plain is indicated by the presence of large, low swampy tracts, numerous scars of abandoned channels of the Sakarya, and cliffs developed by the impingement of streams against hills that now lie away from any active stream course. An old bridge northwest of Adapazari

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suggests that during Justinian times the Sakarya followed a channel to the west of the city and flowed through the Gap of Çark, whereas today it lies well to the east, beyond hills that rise a hundred feet and more above the level of the plain. Ramsay[1] states that the bridge was built in A.D. 560 across the Sangarios (Sakarya), but as the river changed its course the bridge now spans the Melos (Çark). Its length of 435 meters and eight spans were appropriate to the wider channel of the Sakarya, but were wholly unnecessary for crossing the much smaller Çark.

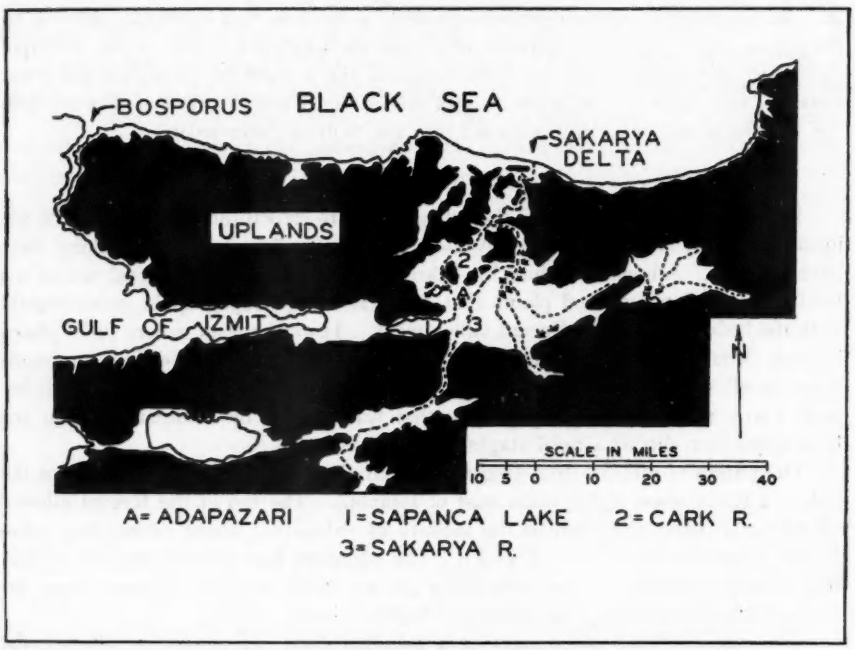

FIG. 1. Adapazari Plain and its surroundings.

SAKARYA DELTA

The gradient of the Adapazari alluvium is about four feet per airline mile, toward the Black Sea. The slope is sufficient to permit the Sakarya to carry a heavy load of sand, even at low stage. At the river mouth an extensive submarine delta is accumulating at a spectacular rate. Sand reaching the relatively quiet water of the sea is dropped to form lenticular bars. Each bar, in turn, splits river currents which bring the sand, forming a bifurcation. Each arm of a divided channel below a bifurcation normally forms its own bar, and hence another set of branching channels. The number of bars and divided channels thus tends to increase outward

[1] W. M. Ramsay, "The Historical Geography of Asia Minor," *Royal Geographical Society, Supplementary Papers,* IV (1890): 214–215, 460.

according to a geometric progression. Sea waves and currents, however, complicate the process, as does the fact that at each branching there is a tendency for one of the arms to wax while the other wanes, eventually to be closed off by the development of a bar across its head. The whole process of deposition, current bifurcation, bar building, and erosional modification occurs at such a rapid pace that a pilot must remain on continuous duty, taking soundings and keeping up with channel shiftings, so that the shallow-draft craft used for fishing or for hauling fire wood to Istanbul may be guided safely in and out of the river. A fisherman commonly leaves in the morning by a complicated route through the maze of sand bars to return that evening by some entirely different set of channels.

The growth of the submarine delta of the Sakarya River illustrates one of the principal processes that determine channel patterns of distributary streams in deltas generally. The branches of the Nile, Mississippi, and other great deltas are not the result of crevassing and diversion of streams across land or marsh to anywhere near the degree that they have been determined by submarine processes which are active ahead of the advancing shore. Delta distributaries are ordinarily relicts of channels that originated out on the bottom in front of the edge of the land.

There is another important generalization regarding stream patterns illustrated at the mouth of the Sakarya; anastomotic channels and braided patterns are the result of processes that take place below water. It is misleading and incorrect to regard one phase of the regimen of a river, say the rising stage, as a time of erosion, and another, say the falling stage, as a time of deposition. The real fact of the matter is that erosion occurs at times of vigorous flow and whenever it is active, deposition is also occurring, and not far away. The more rapid the erosion, the more vigorous the deposition. When a river such as the Platte, or Red River for long stretches between Texas and Oklahoma, reaches flood stage and spreads from bank to bank, both erosion and deposition take place along its bed, at a terrific rate. Materials scoured at some spot on the channel floor are thrown down a few feet away to become part of a bar. As stage drops, the whole process becomes less active, and finally the low-water river winds as best it can through the irregularities left on the bed as a result of the active changes caused by the scour and deposition of the preceding flood. An anastomotic, low-stage stream does little or nothing to modify its channel patterns.

Waves and currents sweep away much of the sand brought to the mouth of the Sakarya, to deposit it as beaches. In proportion to the abundant load furnished by the river, the advance of the Sakarya Delta is quite gradual. Its form is a simple cusp, similar to the classic illustration of the type, the cuspate mouth of the Tiber. Delta growth is not only a matter of extending the river mouth into the submarine delta territory, but also involves growth of the concave beaches on either side. These extend for many miles. It may be expected, at least for some centuries, that the delta will retain its cuspate form and carry the beaches out as the river mouth advances farther north into the Black Sea.

The sandy beach about one-half mile east of the river advanced about 100 yards

during the last 28 years according to an informant who described a swim from the shore to a wreck of a steamer that now lies at the edge of the beach. The hull was soon filled with sand and it seems unlikely that the wreck has been shifted inland for any appreciable distance. The place designated as the shore of 28 years ago had every appearance of being authentic. The width of the entire beach, including dune-covered areas inland, is well over a mile, which suggests an annual advance averaging 3 feet per year over a period of something on the order of 2,000 years, during which it may be presumed that sea level maintained a somewhat uniform stand.[2] That the beach east of the Sakarya has advanced at a rate of slightly more than 10 feet per year during the last 28 years seems reasonable because accelerated erosion is certainly furnishing sediment to the river more rapidly than might have been expected before this part of Anatolia was deforested, over-grazed, and put under the plow. Deforestation became well advanced during the Byzantine Period and has been perpetuated by the factor that makes all Moslem countries appear much more arid than they really are—overgrazing by sheep and goats. Not until the introduction of the plow, particularly in its present form, did accelerated erosion begin to reach present proportions, and not until the advent of the engineer charged with the prevention of floods did streams carry sediment to their mouths so effectively. The Sakarya and many other coasts are undoubtedly advancing at rates which are three times or more rapid than those during most of historic time.

MEANDER VALLEY

The history of Sapanca Lake was repeated toward the mouths of several Anatolian valleys, but nowhere more impressively than near the delta of the Meander River, in the southwestern part of the peninsula (Fig. 2). Alluvial drowning of the Meander Valley has dammed its last left-bank tributary so completely that Bafa Lake has been created. This large, fiordlike body of water was said to be 25 or 30 fathoms deep by local fishermen. I was unable to verify this astonishing estimate, but did ascertain the fact that these fishermen actually think in terms of fathoms, rather than meters or other units, for the reason that they ordinarily use charts marked in fathoms. In any event, the deep blue water of the lake on a clear day suggests considerable depth, and a depression of 150 feet or so might not be anomalous behind an alluvial dam which must be at least 300 feet high. In the Adapazari Plain the Recent alluvium has been drilled to a depth of nearly 200 feet without reaching its base. More precise information from the coast of Louisiana

[2] The evidence for this statement is from the mouth of the Mississippi, where an abundance of information from borings has made it possible for H. N. Fisk to follow the thalwegs of a number of successive meander belts southward to the Gulf of Mexico: *Geological Investigation of the Alluvial Valley of the Lower Mississippi River*, U. S. Corps of Engineers, Mississippi River Commission, Vicksburg, 1944. There is a slight rise in sea level at present, and the total melting of all continental ice on Antarctica and Greenland would raise the oceans by something on the order of another 50 meters, but fluctuations appear to have been less impressive than most European geomorphologists advocate for the past twenty centuries. Thalwegs leading to a level of −20 feet in the Gulf of Mexico may be 3,000 or more years old.

indicates a magnitude in excess of 400 feet for the Recent rise of sea level.[3] Bafa lies about eight miles back from the Aegean, airline.

The Meander Valley is straight as it extends up a graben which trends eastward, past Aci Lake. Seismic activity is intense; earthquakes are both frequent in occurrence and in many historic cases, extremely destructive. Hot springs are numerous, and some have deposited huge volumes of travertine. A saline spring not far west of Söke accounts for the presence of a rather large salt marsh which lies well inland from the coastal marshes. Quaternary terraces have been rotated so that

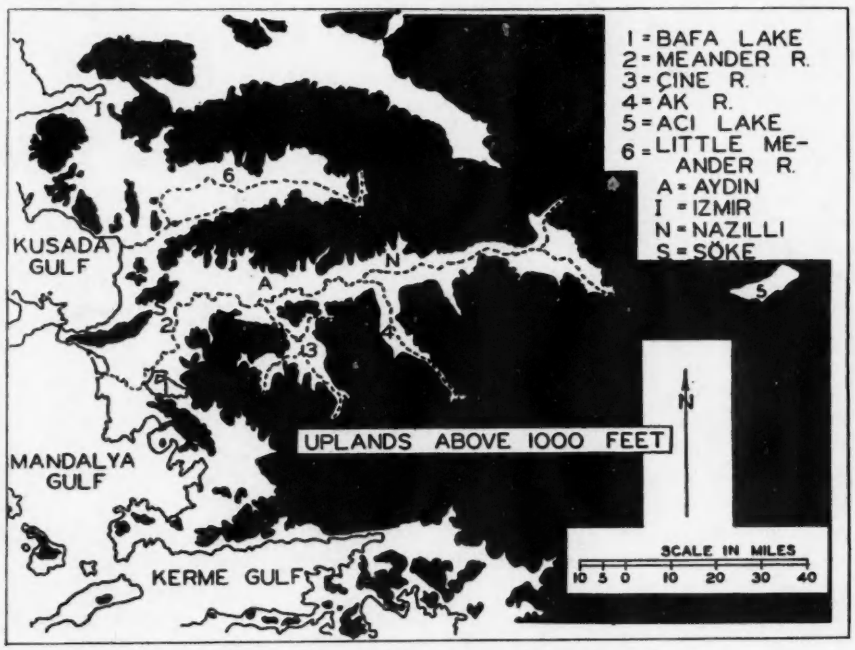

FIG. 2. Meander Valley and its surroundings.

their surfaces tilt as much as 10° toward the northern wall of the valley just east of Nazilli, and others north of Aydin have been displaced in a similar manner. But in spite of all these evidences of crustal unrest the floor of the Meander Valley is dominated by landforms of alluvial origin for well over one hundred miles inland from the sea.

Extensive cones of dejection (alluvial fans) fill most of the valley above Nazilli. Here the flat flood plain is a minor feature, its width and position being determined by the distances to which tributary streams have pushed their cones out from the

[3] R. J. Russell, "Coast of Louisiana," *Bulletin de la Société belge de Géologie, de Paléontologie, et d'Hydrologie*, LVII (1948): 380–394.

bedrock valley wall. As a rule the cones from the north are larger and longer, so the river has been forced toward the south valley wall, at some places against the bedrock of the hills. There is little opportunity for the river to meander anywhere along the upper two thirds of its graben valley. Its flood plain is narrowly restricted by deposits of sand and gravel along the fronts of cones. Most of the fanglomerate is coarse, boulders over a foot in length being numerous along practically all tributary streams and across cone surfaces where fields and orchards have not been cleared of them.

The effects of alluvial drowning appear in the vicinity of Nazilli. The propor-

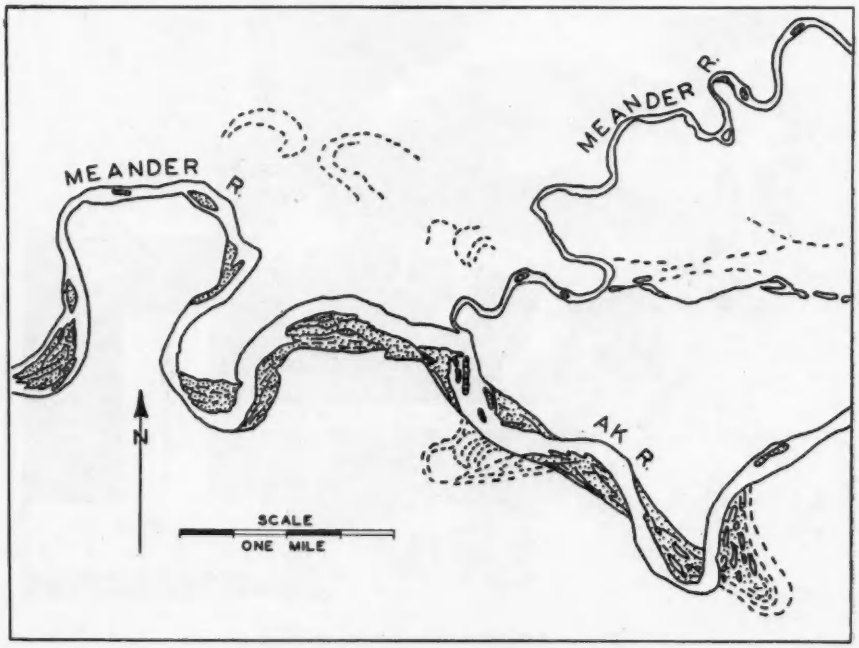

FIG. 3. Junction of the Ak and Meander rivers.

tion of valley floor covered by cones decreases and the relatively flat flood plain becomes correspondingly wider. The river meanders with some vigor at several places above the junction of the Ak, a tributary from the south that has a profound effect in changing the pattern of the Meander downstream (Fig. 3).

The Ak is subject to violent floods, and at low water occupies broad, braided channels through gravel and sand bars. The quantity of coarse alluvium brought to the Meander flood plain is sufficient to increase its sandiness for several miles downstream, to account for the development of large sand bars along the Meander channel for a similar distance, and, as a result of the rapidity of bar growth, to intro-

duce a pattern of much larger meander loops along the channel. Sandy islands (towheads) become numerous below the Ak. They create a tendency for the Meander to assume a braided course during low stage.

The scars of abandoned channels become more numerous below Nazilli. The extensive cotton fields of the flood plain are interrupted by arcuate depressions which are parts of old channels. Lakes appear in many of the deeper scars during the rainy season, and a few persist perennially, to become surrounded by willows and other trees. In the delta region some of the old channels become active during

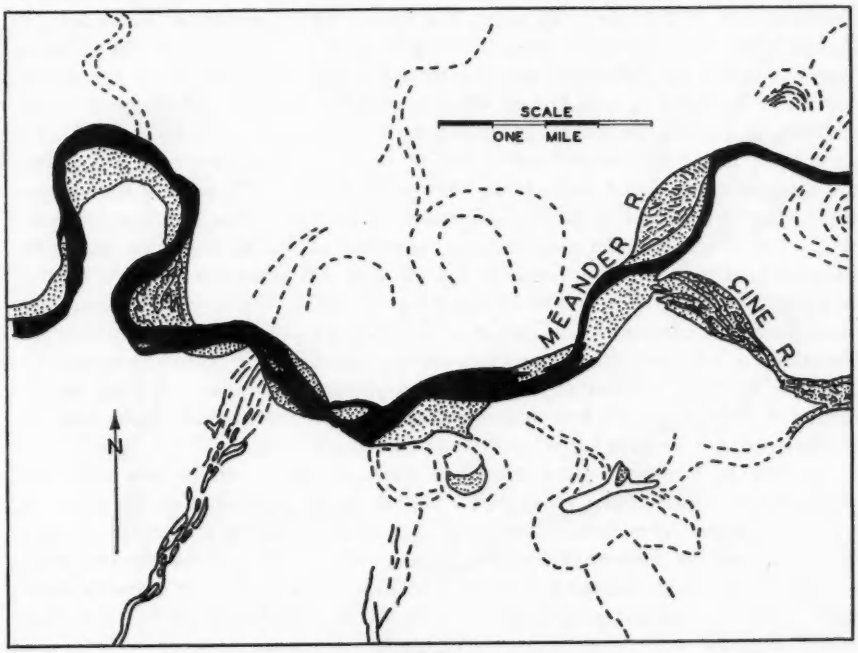

FIG. 4. Junction of the Çine and Meander.

higher stages of the river and retain beds of soft, mud-cracked clay throughout the dry season. These make it difficult to travel by automobile, or even by a four-wheel-drive Jeep.

The entrance of the Çine River, south of Aydin, introduces changes in stream patterns and floodplain composition that are similar to, but less striking than, those below the Ak (Fig. 4). A stretch of river with fairly well developed meander loops is changed into a partially braided channel, with large bars, several towheads, and some comparatively straight channel segments. An abundance of sand mixed with the silt of the flood plain accounts for a shoal channel, considerably wider than either that upstream, above the Ak, or downstream, toward the delta.

Relict channels locally include both the narrower traces of the Meander and the wider depressions of the combined Meander-Çine.

Several miles below the Çine, the Meander again narrows and deepens, and its pattern becomes one of comparatively uninterrupted meandering. These characteristics are retained practically to the coast, and this lower course may be regarded as the "type-locality" of river meandering, for Herodotus[4] compared the Meander with the Nile with respect to its windings. Strabo[5] described the river as "so exceedingly winding that everything winding is called 'meandering'."

West of Aydin, long cones of dejection from the northern valley wall force the Meander south of the axis of its valley, a condition which persists to the vicinity of Morali, a village about eight miles northeast of Söke (Fig. 5). Here the trend of the north wall of the valley changes from westward to southwestward for the reason that it is determined by a fault zone which is slightly oblique to the direction of the graben. Along this southwestward valley wall the Meander is influenced only by short, steep cones. Many of these exceed 5° in slope where they enter the valley, and some were measured with slopes of from 6° to 10°. Those with the steeper slopes are characterized by particularly coarse gravels and large boulders. Several old courses of the Meander approach the valley margin closely along the wall with the short fans, and not many centuries ago the river ran along the northern edge of its flood plain for a considerable distance beyond Söke. Relict channel scars are particularly numerous and interesting between Morali and the coast. Though the Meander has followed various routes to the sea, alluviation is occurring so rapidly that it is doubtful whether any channel now preserved in relict condition in the vicinity of the delta is over two thousand years old. Herodotus and Strabo referred to courses that have been buried under subsequent alluvium.

The tendency shown by the latest two major meander belts to hug either the north or south wall of the valley below Morali is an expression of the effect of active faulting in either location. Not only are the hills being uplifted along each valley wall, but the downward movement of the valley block involves rotation which is active enough to attract and to trap the river in the zone at the base of each escarpment. This is a familiar pattern in the Great Basin of the United States and other seismic regions.[6]

The accompanying map of the lower Meander Valley (Fig. 6) is a modification of Philippson's map of 1911.[7] It indicates how the "Old Meander" channel continues along the base of the narrow alluvial apron, close to the hills southwest of Söke, for about 10 miles, after which it turns and runs directly southward across the

[4] II, 29.

[5] 12.8.15–17.

[6] A. C. Lawson, "The Recent Fault Scarp at Genoa, Nevada," *Bulletin of the Seismological Society of America*, II (1912): 193–200; R. J. Russell, "Basin Range Structure of the Warner Range, Northeastern California," *University of California Publications, Bulletin of the Department of Geological Science*, XVII (1928): 387–496, reference on pp. 493–494.

[7] A. Philippson, "Reisen und Forschungen im westlischen Kleinasien," *Petermanns Mitteilungen, Ergänzungsband* Heft Nr. 172 (1912); description of Lower Meander Valley, *idem*, Heft Nr. 183 (1915): 2–3, 10–11.

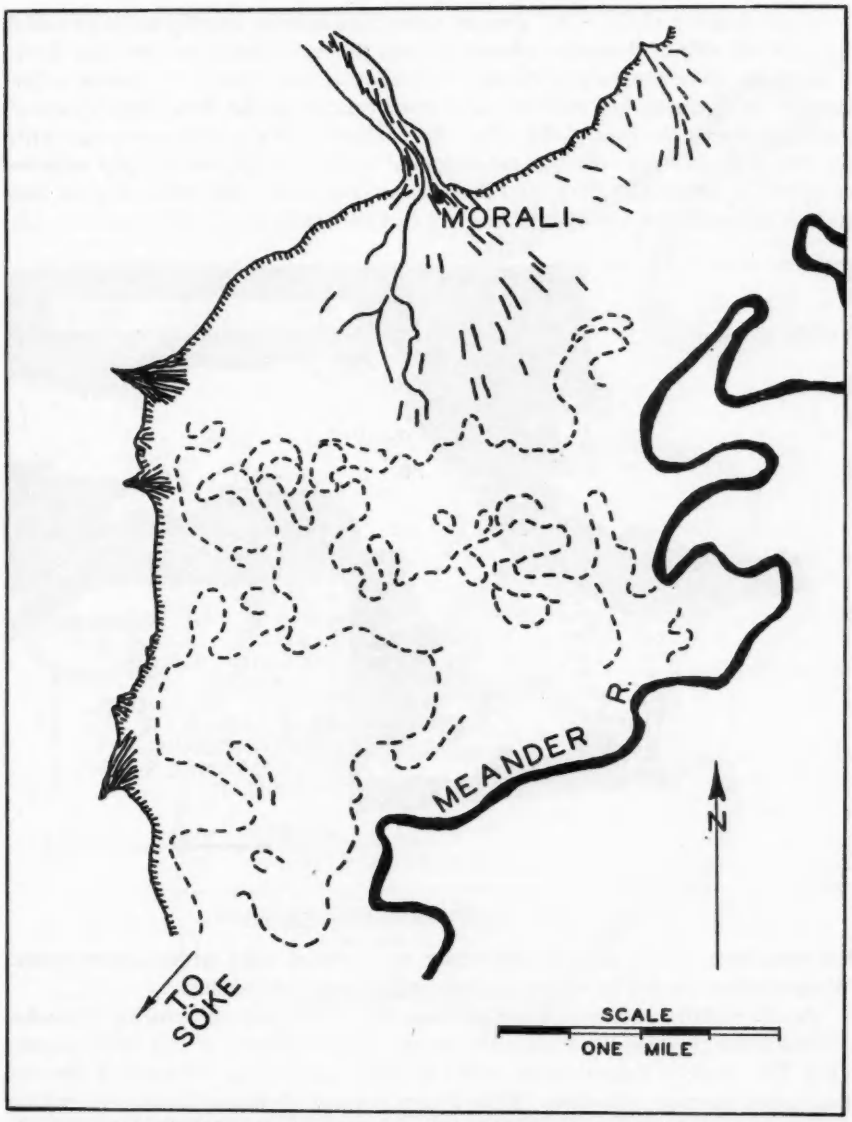

FIG. 5. Present and past courses of the Meander northeast of Söke.

width of the flood plain, to the base of the apron across the valley. This channel is fresh in appearance today and carries considerable flow when the river reaches high stage, though at low stages long stretches are completely dry.

A continuation of the "Old" channel from Söke leads to marshy territory along the northern side of the valley toward Karina, the main lagoon on the right flank of the delta. The presence of this low area and the preservation of Karina, or its possible enlargement, are results of continued rotation of the valley-floor block of the fault zone at the base of the hills. A comparison of the Philippson map with the 1936 issue of the 1 : 800,000 topographical map of Turkey or the 1949 revision of World Aeronautical Chart 342 (Dodecanese Islands, 1 : 1,000,000) suggests that Karina has grown considerably in size and that the sandy beach along its outer side

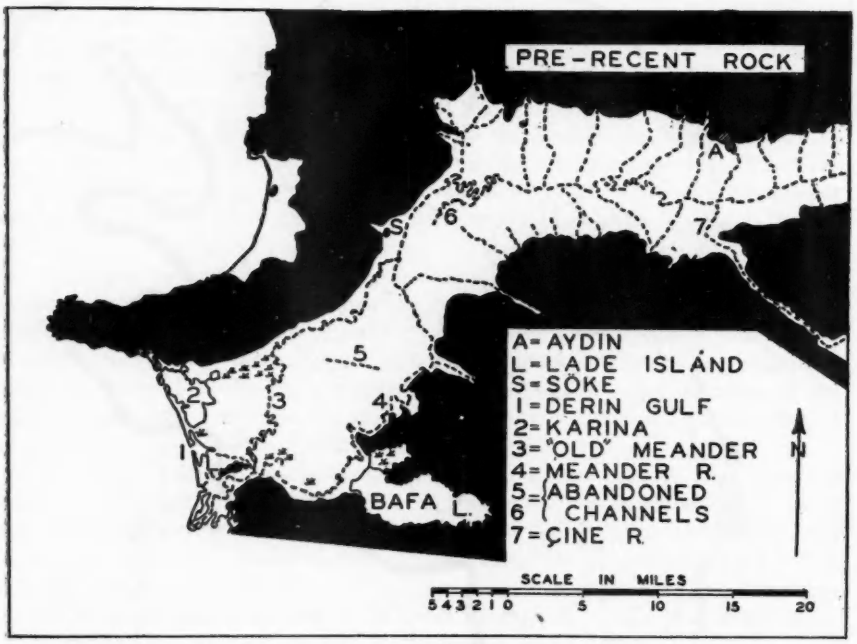

FIG. 6. Lower Meander Valley (after Philippson).

has been breached by considerably wider wave-eroded gaps within recent years. Wave erosion is aided by a comparatively rapid rate of subsidence.

In the vicinity of the junction between the "Old" and the existing Meander courses south of Söke, the flood plain retains many remnants of still older courses (Fig. 7). Some of these truncate others abruptly, establishing the relative age distinctions of younger and older. With adequate aerial photographs and information from borings it would be a relatively easy task to reconstruct a long history of flood-plain development, establish the relative ages of natural levee systems, and to explain the distribution of each alluvial or soil type in the lower Meander Valley.

The general pattern of loops along the "Old" and existing courses is similar,

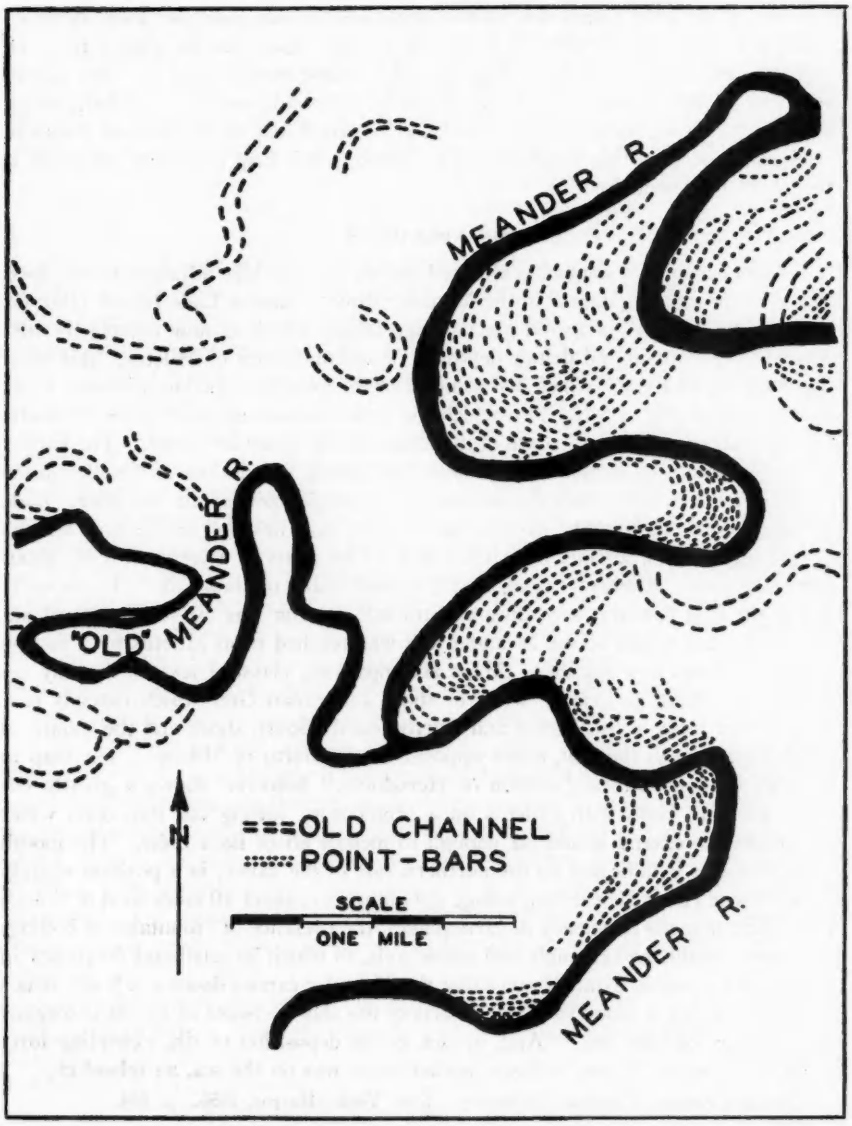

FIG. 7. "Old" and existing Meander courses south of Söke.

though the earlier course is somewhat more complex for the reason that it served as the main channel for a greater length of time and therefore had a greater opportunity to develop minor kinks along its meander loops. The point-bar accretion

scars, which are little ridges and swales developed as each meander loop increases in size, are much fresher along the existing course. Each bar is sandier than the swales adjacent on either side. Along the older course the bar sand has been spread about and in places concentrated into dunes by the wind; some of the dunes being 10 feet high. It is characteristic of the "Old" channel that sandy areas or dunes of various sizes occur within meander loops. Much of this land is unused today and is overgrown with wild licorice.

MEANDER DELTA

Miletus occupied a somewhat elevated site on the low hills adjacent to the flood plain near the existing course of the Meander directly east of Lade Island (Batmaz Hills). The "island" is an old glacial-stage hilltop which is now completely surrounded by floodplain and deltaic deposits. The importance of Miletus, "this most celebrated city of Ionia," which had some 75 or 80 colonies, was due primarily to its location on the side of a bay into which the river Latmus emptied, some 80 stadia (probably about nine miles) south of the mouth of the Meander River.[8] The harbor was large enough to shelter a large fleet, but during the decline of the Byzantine empire Miletus suffered from the increasing alluvial deposits of the Meander. Lade was described by Herodotus[9] as being an islet, but now lies well inland, and Miletus is some eight miles, airline, from the coast. The ruins of Pyrrha now lie about eight miles above Miletus by road, near the small outlet of Bafa Lake. In the early part of the first century, according to Strabo,[10] Pyrrha was 50 stadia (about six miles) from the mouth of the Meander and was reached from Miletus by a voyage through shallows and marshes. Maps accompanying classical texts ordinarily reconstruct the local geography so as to show a Latmian Gulf which extends past Lade toward Bafa, with Miletus and Pyrrha on the south shore and the mouth of the Meander across the gulf, about opposite to and north of Miletus. The map in the Loeb Classical Library edition of Herodotus,[11] however, shows a greatly enlarged Latmian Gulf, with Miletus on a promontory jutting out into open water that appears to extend inland far enough to include all of Bafa Lake. The mouth of the Meander is indicated on the northern side of the valley, in a position slightly east of Priene (near the existing village of Güllübache, about 10 miles west of Söke). After discussing the frequency of earthquakes, the presence of "fountains of boiling-hot water," friable and crumbly and saline soils, to which he attributes frequency in changes of its course, Strabo[12] notes that the Meander carries down much silt, which at different times is added to varying parts of the shore. Some of its silt is forcibly thrust out to the high sea. "And, in fact, by its deposition of silt, extending forty stadia, it has made Priene, which in earlier times was on the sea, an inland city."

[8] Charles Anthon, *Classical Dictionary*. New York: Harper, 1856. p. 844.

[9] VI, 7.

[10] 14.1.8–10.

[11] T. E. Page, E. Capps, and W. H. D. Rouse, editors: A. D. Godley, translator: *Herodotus*, I. Cambridge and New York: 1931.

[12] 12.8.15–17.

Thus, within the period of observation of the ancients, the lower Meander Valley was fairly estuarine. The boundary between water- and alluvial-drowning of the old ice-age valley appears to have shifted downstream something on the order of 10 miles during the last 25 centuries. Low, marshy area extending inland from Derin was the site of open water that once reached Priene, and the alluvial dam that now creates Bafa Lake probably became effective only during historical time.

Malte-Brun[13] discussed the origin of Bafa, citing the diverse opinions of Chandler, Mannert, and Barbié du Bocage, and apparently favored the idea that the natural levee of the Meander closed the lake basin by extending westward across the old Latmian Gulf, toward Pyrrha; which, indeed, was the case. The channel of the "Old" Meander of Philippson seems to approximate generally the active route of the river some twenty centuries ago, but the existing course—the one which closed Bafa Basin—(course 4 in Fig. 6) appears to be the result of a comparatively modern diversion in territory south of Söke (Fig. 7). It was not until this modern course was adopted that the natural levee leading toward Pyrrha and Miletus was created, and Bafa became a separate entity, rather than the deep head of a long estuary. The lake is somewhat saline today, not enough to interfere with its use as drinking water for sheep, goats, and camels, but enough to render it a bit impotable for man. It seems probable that this salinity is residual and that it is gradually being reduced by dilution. Small losses of Bafa water occur during periods of heavy rainfall, when there is general overflow across the Meander natural levee, and by the trickle that flows along the outlet near the ruins of Pyrrha. It is less likely that the salinity is that of a terminal basin, for the region is by no means arid. There may be some contribution of salts from local bedrock or alluvium. This question could be solved by a chemical analysis of Bafa water. If it is dilute sea water, the salinity is residual and must be decreasing in its concentration.

All of the most recent maps of the Meander delta indicate the active channel as passing south of Lade Island. This course leads to two natural-levee prongs which extend some distance into the sea, one to the south and the other to the west. These southern outlets were abandoned, however, during a flood in the winter of 1945–1946, when a diversion occurred to the west of Balat, the modern equivalent of Miletus. The diverted channel runs to the north of Lade, and started to follow an old distributary which was indicated by Philippson as extending into Derin Gulf, but crevassed across the left bank, so that the actual mouth of the river now lies a bit to the south of Derin.

Both of the main lagoons of the delta, Derin and Karina, are practically filled with sediment today. They are fronted by comparatively smooth sandy beach which is arcuate as a result of wave attack and the shifting of sediment by currents. A belt of low dunes occurs between the outer beach and an inland tidal flat. Floodplain deposits are eagerly utilized for cotton growing as they spread downvalley into the lagoons. The cotton is stunted in saline alluvium, and it is not uncommon

[13] Malthe-Conrad Brunn (Malte-Brun), *A System of Universal Geography*. James G. Percival, Editor. Boston: Samuel Walker, 1834. Vol. I, p. 240.

to find salicornias growing as weeds between its rows. Aside from a strip along the northern part of Karina, which may be sufficiently lowered by faulting to escape, it may be expected that alluviation during the next few centuries will extend agricultural land across the lagoon sites to the dunes along the beach. Tamarisks and licorice bushes accentuate the height of natural levee crests in this low and relatively flat territory. Licorice also springs up densely as a volunteer crop in fields that have not been plowed recently.

LITTLE MEANDER DELTA

The Little Meander Valley, which lies about twenty miles to the north, duplicates on a modest scale many features of the Meander Valley. Ephesus had a position corresponding with that of Miletus. Commercially it was superior because it served most of the Meander Valley as well as its own natural hinterland. A good route led from Aydin to Ephesus, so that the last home of Saint John and, according to recent information of Turkish archeologists, that of the Virgin Mary,[14] was actually more accessible to most of the Meander Valley than was Miletus, which lay across marshes, low ground, and a lagoon. Ephesus is now located a little over four miles inland for the reason that rapid alluvial drowning has pushed the shore seaward from its old harbor.

Aside from discrepancies in size, the main element of contrast between the two Meanders occurs along the coast. Waves and currents have subdued the irregularities of fluvial deposition more effectively along the front of the smaller delta. The shore is a long, smooth arc, concave toward the valley. Behind the beach lie six or more sandy strips which mark stages of progression of the last quarter-mile of coastal advance. These correspond to the cheniers[15] of the Mississippi, Rhône, Po, and other advancing alluvial coasts. Half a dozen or more periods of rapid advance have been halted long enough to permit the forming of a conspicuous beach by wave action, but the main growth has been outward, so that older beaches have been preserved in relict condition and now lie inland, as cheniers. The Little Meander is at present confined to an artificial channel which leads to the north side of its delta. A long prong of natural levee and adjacent mudflat is in an incipient stage of development at the new mouth.

CILICIA TRACHEIA

The steep coast of southern Anatolia, from east of Antalya to Mersin—Cilicia Tracheia—"is narrow and has no level ground, or scarcely any; and besides that, it lies at the foot of the Taurus, which affords a poor livelihood."[16] Long the base

[14] The authenticity of this report is being investigated by Vatican scientists. Meanwhile, the Turks have erected a dignified shrine at the location, in the hills to the southwest of the ruins of the city and some six miles distant, and are building a modern highway from the nearby town of Selçuk.

[15] R. J. Russell and H. V. Howe, "Cheniers of Southwestern Louisiana," *Geographical Review*, XXV (1935): 449–461; R. J. Russell, "Geomorphology of the Rhône Delta," *Annals of the Association of American Geographers*, XXXII (1942): 149–254.

[16] Strabo, 14.5.2–4.

for pirates, this wild territory is characterized by small rivers that flow rapidly and transport coarse debris to the small deltas of their alluvially drowned mouths.

Earthquakes must be severe to the west of Alanya, for the Recent has witnessed uplift that has raised a platform of marine abrasion to a level of some 50 feet and has tilted beaches so that their inner sides now lie well above the sweep of the highest storm waves. Even this spectacular crustal activity has not overcome the effects of alluvial drowning. Each valley mouth preserves either an estuarine indentation or an alluvial cone or flat bordered by steep walls of bedrock. East of Alanya the evidences of rapid Recent uplift disappear. At Gazipaşa, three streams converge

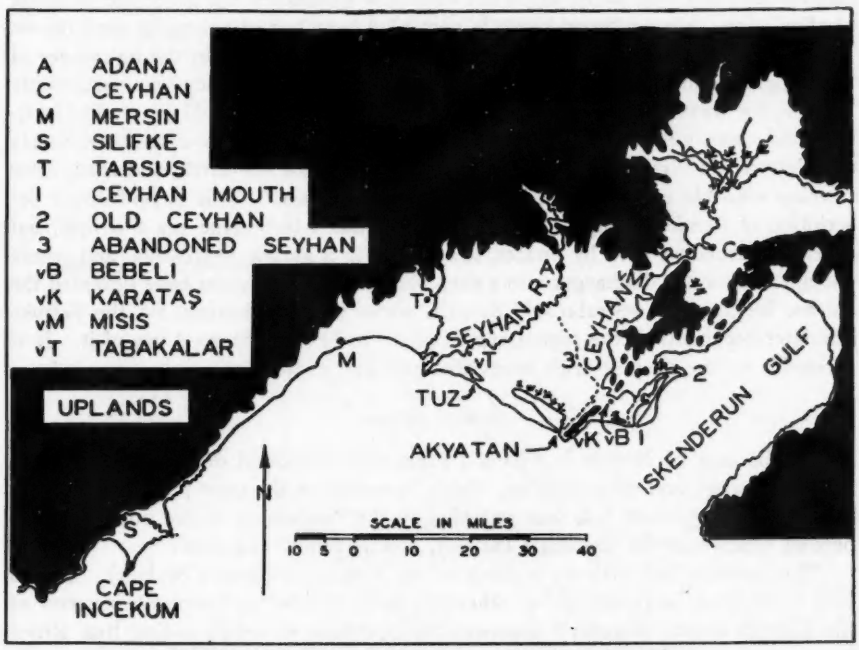

FIG. 8. Mediterranean Coast of southeastern Anatolia.

toward a beautiful deltaic flat in territory rugged enough to resemble the head of a fiord in Norway. Kalediren Valley terminates in a large alluvial flat, strewn with boulders up to a foot in diameter. Bozyazi Valley has a deltaic plain with an area of about 16 square miles, one of the largest and most productive along this semi-tropical coast, which raises peanuts, rice, taro, and bananas. Degirmen Valley and a large valley east of Gilindire display the effects of alluvial drowning magnificently, as do others toward Silifke. A road now under construction will make accessible for the first time a coast surpassing in scenic grandeur the Santa Lucia Coast of California, south of Carmel. The small delta settlements have been served hitherto by little streamers and sailing craft on something like fortnightly schedules.

The Göksu, which flows past Silifke (Seleucia), has built a large delta that juts out to Cape Incekum, in the Mediterranean. An older course of the river reached the cape, which is nothing more than the sand of natural levees, but the more recent channel leads eastward to a secondary projection of land. Subsidence of the delta is evident along a low, marshy inland border, which appears to owe its position to faulting, as it is comparatively straight and is the site of some large active springs. Much of the original backswamp on either side of the natural levees toward Cape Incekum has been converted into lagoonal ponds and low marsh as a result of subsidence. The entire west coast of the Göksu Delta is low in comparison with the recently building east coast, where the effects of subsidence are overcome by those of alluviation. Here a broad beach is paralleled by a belt of enlarging sand dunes.

A remarkable area of karst topography has been developed in the limestones of the rugged mountain front east of the Göksu Delta. Here piracy was particularly favored, for there was a supply of good timber, strongholds could be readily fortified, and there were many secret recesses. Strabo[17] comments upon these assets and describes a river which "forthwith empties beneath the earth, and then, after running invisible underground, issues forth into the sea." This is probably a description of Cennet Obrugu (Paradise Hole), near which some say a temple, but others a warehouse used by pirates, lies hidden in a karstic depression, and where enough fresh water discharges into a deep blue inlet that boatmen have skimmed the surface for supplies. Strabo said that the water was foul tasting, but the Seljuks and later occupants of the region are supposed to have made good use of it. It is accessible to the deepest-draft boats that ply that coast.

CILICIA PEDIAS

To the east of Mersin is Cilicia Pedias, the compound delta of the Ceyhan, Seyhan, Tarsus, and other streams, which "consists for the most part of plains and fertile land." Ancient Soli was regarded as the "beginning of the other Cilicia," beyond which was the Cydnus (Tarsus), and Pyramus (Ceyhan).[18]

The ancients had little or nothing to say about the Sarus (Seyhan). Strabo fails to mention its mouth in his otherwise quite detailed and accurate account of the Cilician coast. Ramsay[19] discusses this question in detail, noting that Ritter "mentioned with toleration though not definitely" accepting the views of Langlois that the Seyhan and Ceyhan at various times were joined upstream, so that the Pyramus mouth served for both. Shortly after the time of Strabo, Ptolemy definitely stated that the Sarus did not join the Pyramus. This statement caused Ramsay to favor the idea that the Seyhan at the time of Strabo entered an inland lagoon near the village of Merkez, to the west of Akyatan, and that later it worked through the coastal belts of dunes to reach the sea 9 [Roman] miles east of the mouth of the Tarsus and 15 miles west of that of the Ceyhan. Actually there are

[17] 14.5.5–6.

[18] Strabo, 14.5.4, 8, 10.

[19] W. M. Ramsay, "Cilicia, Tarsus, and the Great Taurus Pass," *Geographical Journal*, XXII (1903): 357–413, with maps facing p. 484; references on pp. 361–364.

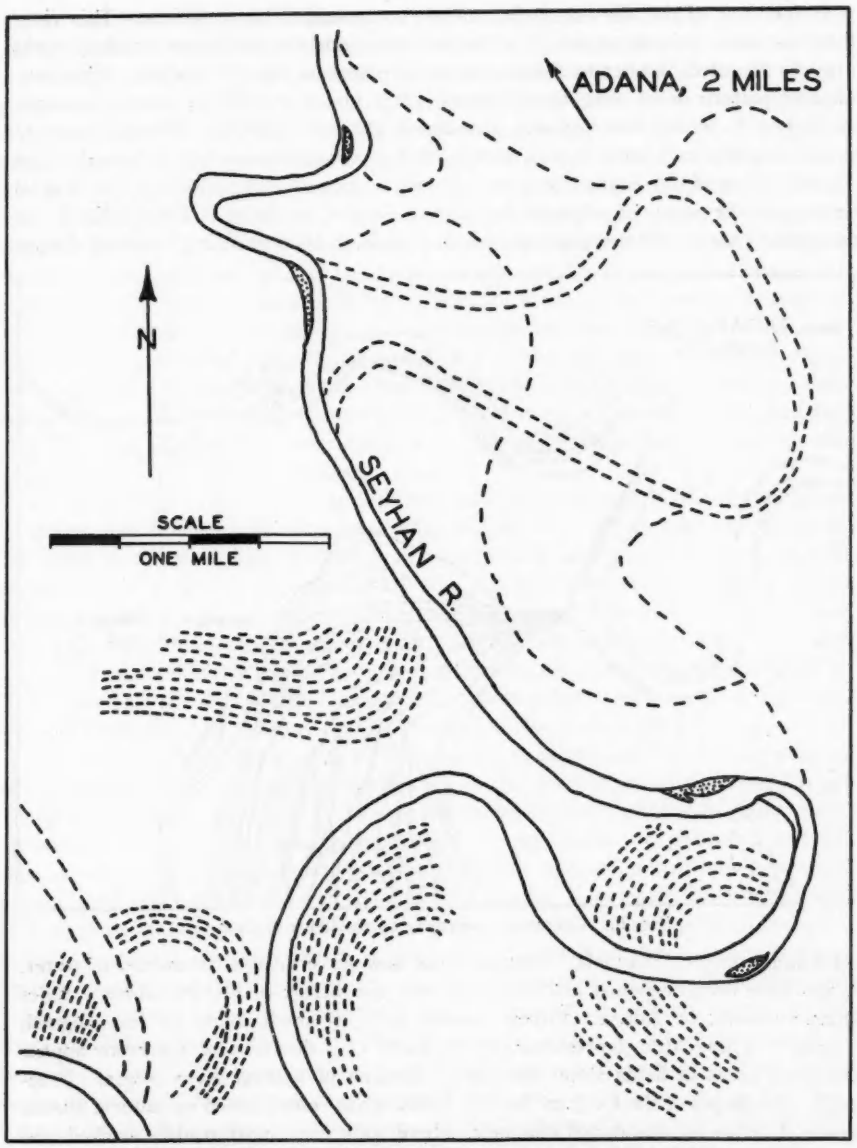

FIG. 9. Seyhan channels and bar accumulations south of Adana.

many old Seyhan courses in the vicinity of Merkez, but there is little reason to accept Ramsay's suggestion.

In spite of the silence of Strabo and others, the Seyhan River is responsible for

well over half of the alluvial surface of the compound delta of Cilicia. This river fluctuates widely in stage and prior to the construction of extensive training works brought repeated disaster to Adana and many places on the plain below. The complicated pattern of its most recent meanderings in the vicinity of Adana is shown in Figure 9, where two recently abandoned channel segments, several traces of earlier courses, and some conspicuous point-bar accumulations are indicated. The natural levees of old Seyhan courses are well developed and commonly rise several feet above the floors of adjacent backswamp basins, so there is little difficulty in recognizing them. Numerous depressions remain in subdued form, marking deeper

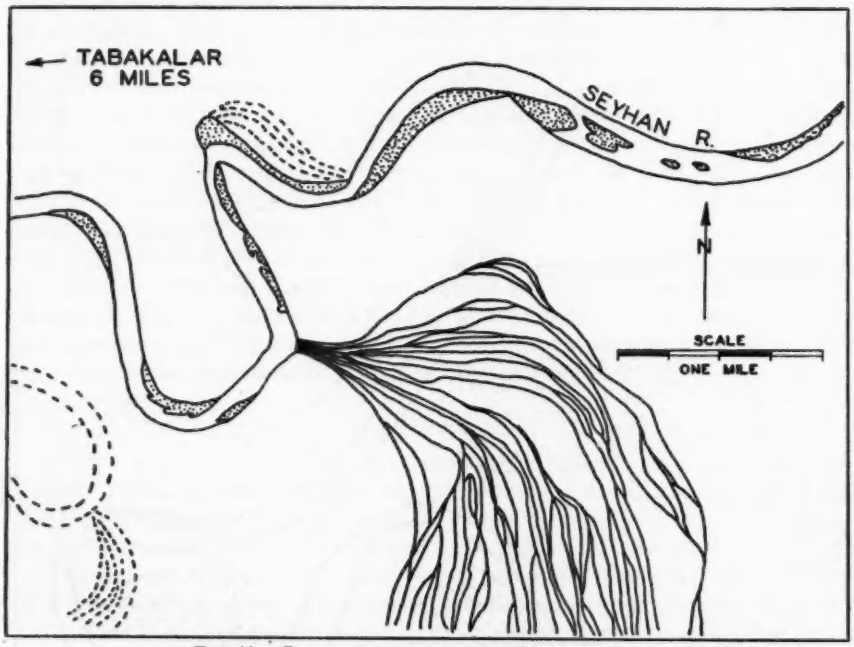

FIG. 10. Crevasse topography on the lower Seyhan.

holes along original channels. Some of these now serve villages as sources of water. A few have been deepened artificially, as near the village of Kayirli, about 7 miles south-southeast of Adana. Others remain only as small, more or less aligned, "pocks." These little depressions are typically clay floored and therefore appear as barren areas in fields along the fertile alluvium of natural levee ridges. Practically all villages of the Ceyhan-Seyhan deltaic plain were located on natural levees, either of active or abandoned channels, where soils were most readily worked and floods might be escaped to varying degrees.

The winding natural levee systems with their sandier point bars and "backswamp" flats are here and there modified by the presence of crevasse topography

which was created suddenly when some flood overtopped a natural levee. Flow is initially swift as water pours through a well developed crevasse and down the steeper part of the backslope of a natural levee for some distance below the crest. Erosional scour charges the escaping waters heavily with silt and sand. Where the gradient decreases toward the foot of the levee, the flood channel braids and subdivides in a complicated manner. An excellent example of the pattern occurs well downstream on the left bank of the Seyhan, about six miles east of the village of Tabakalar (Fig. 10). Spreading in a deltaic manner below an apex at the point of crevassing, the area of alluvial deposition in the zone of braided channels attained a local relief of up to three feet, between the crests of lenticular bars and the depressions along minor thalwegs in the maze of channels lying adjacent to them. The alluvium in areas of crevasse topography is ordinarily coarser in texture than that which it covers, and hence is more valuable agriculturally, particularly after the lapse of several years, when the initial relief is subdued and the deposits remain visible mainly because they are sandier or siltier than the heavier soils of flats beyond. The cotton stands higher and looks sturdier here and there along the Seyhan or Ceyhan where it grows on old areas of deposition below crevasses.

The excellent system of dikes that has been built recently in the deltaic plain of Cilicia will undoubtedly reduce hardship and misery, but, in the long run, will not be an unmixed blessing. Flood losses which have long plagued the region will be reduced, or possibly overcome, but the land will be robbed of the beneficial effects of alluviation. To the extent the dikes confine water to the main river channels they will deprive the plain of silt capable of developing productive soil. The fact that concrete revetments have been built to reinforce the dike at the crevasse east of Tabakalar and at various other weak spots where other overflows have occurred indicates a determination to stop future flooding of the Seyhan lowlands.

The achievements of engineers in training rivers extend well beyond the control of crevassing. One of the main objectives is the prevention of diversions from "original" to "new" channels. It is to the advantage of most settlements along rivers to retain their positions, for purposes of water supply, harbor development, and the like, so engineers are commonly charged with the task of perpetuating existing stream patterns. As a rule it is extremely expensive to prevent the enlargement of a meander loop, as in many cases nothing short of creating an artificial channel—such as along a flume protected by a thick mat of asphalt or slab of concrete from the top of one bank to the top of the other—will prevent the growth of bars and their consequent restriction of channel cross section, which, in turn, results in the undermining of the "cut bank," so that it is driven outward. In most cases it is considered more prudent to move the dikes back far enough to prevent their being undermined, with the hope that a bend will reach the cutoff stage before the "setbacks" become altogether unreasonable. It must be remembered that dikes serve only to prevent overflow; they have no effect whatever in preventing recession of cut-banks, unless reinforced by revetments, and in such cases the effect is only temporary because the reduction of the channel cross section by the growth of the bar

on the point opposite forces the water to scour and eventually to deepen the channel so far that the whole revetment is undermined and slips off into the channel.

If a meander loop grows to large size and is dike-protected while doing so, the river may erode laterally beyond the original width of its natural levee. The dike must be increased in height as it is set-back to lower levels and may become unreasonably high and heavy. The decreasing stability of foundation materials from the firm silt of the natural levee to the more clayey backswamp introduces the hazard of far more serious flooding than takes place along undiked rivers. Water crosses natural levees slowly and along considerable distances of over-topped banks, but pours violently from a concentrated opening if a flood-stage break occurs in a high dike. Many cases of complete losses of natural levees have occurred in the Lower Mississippi Valley, where dike protection has existed for many years. In Cilicia the dikes are too new to have had any such consequences, but channel changes will occur rapidly enough to demonstrate, in the not distant future, the proposition that engineered rivers are not entirely beneficial to the economy of their flood plains. Without engineering a natural levee is renewed during the entire process of loop enlargement, so the area of good agricultural land is not diminished.

In the normal course of events the enlargement of a meander loop now and then results in the complete diversion of the downstream channel of a river, but a stream which is successfully engineered will be prevented from acquiring new courses, so that new systems of natural levees will not be permitted to develop across their flood plains. As most, if not all, deltas are subsiding areas, the lowering of backswamps toward coasts results in a loss of land useful to man if the beneficial effects of alluviation are not allowed to compete with the detrimental effects of regional sinking. Much farm area has been lost to the east of New Orleans for this reason, and a similar experience undoubtedly awaits territory toward the Cilician coast.

The subsidence of the Ceyhan-Seyhan deltaic plain is demonstrated by several lines of evidence. The general dip of older rocks toward the delta indicates a long continuance of the process. The seaward dip of levels from which supplies of artesian water are obtained brings the matter into closer perspective. A flowing well in the village of Sazak, about 12 miles south of Adana, obtains excellent water from an aquifer 20 meters below the surface, whereas at Karagöcer, about 21 miles south-southwest of Adana, similar water rises from a depth of 70 meters. There are, of course, many different aquifers beneath the deltaic plain. At Badras, about 10 miles east of Tarsus and 12 miles inland, water is obtained from a depth of 52 meters, while a short distance east of Mersin it stands in coastal wells less than 5 meters deep. The Badras water, however, has an organic taste and is certainly not the same type that occurs at Sazak and other places which have relatively pure supplies, and the coastal waters are nothing more than accumulations in superficial sand, wholly unrelated to artesian aquifers. A general check on the levels from which true artesian water is obtained indicates the probability that the dip of the Recent sediments is pronounced in the seaward direction, as is also the case in more completely known deltas generally. Another evidence of subsidence, in which the

coastal region is lowering more rapidly than apical parts of the deltaic plain, is the extent to which saline flats and tidal inlets extend inland.

Salicornias and other salt-tolerant plants extend inland across depressed areas of various kinds as far as a line between the village of Zekis, about 8 miles inland from Karataş, and the village of Meletmez, about 12 miles northwest of Karataş, and westward to the vicinity of Tabakalar, near the Seyhan River. Much of the area toward the coast from this boundary consists of low, clayey flats covered with rushes, with scattered patches of reeds in places that remain wet during the summer. *Cardium edule* and other brackish-water animals thrive in ponds and along abandoned stream channels. Salt-encrusted flats which are flooded when the Mediterranean stands high extend broadly inland from the large lagoons of Akyatan and Tuz. Aside from several belts of dunes along the coast, the only high land between the mouth of the Tarsus and the hills toward Bebeli consists of natural levees along the more recent channels of the Seyhan and Ceyhan rivers. Older natural levees are submerged below the levels of marshy flats. This whole zone of saline and brackish waters will encroach inland at an accelerated rate as the effects of river training become more decisive.

It is difficult to exaggerate the extent to which the Seyhan has meandered and changed its course across the deltaic plain within historic time. It is likely impossible to travel as much as three miles in a straight line anywhere between the lower Seyhan and Ceyhan rivers without crossing some obvious old channel or natural levee system of the Seyhan. There is a corresponding complexity in the alluvial history in the vertical sense, for practically any excavation ten feet or more deep will display a section not only of the tan silts characteristic of Seyhan natural levees but also layers of sand or gravel which accumulated on bars along active channels, or below crevasses.

To the west of the Tarsus all traces of Seyhan channels disappear. Most of the surface is the result of the depositional activities of small streams, such as the Deliçay. These have deposited their cones of dejection rapidly below courses that dissect a Pleistocene deltaic plain which at places extends some distance south of the direct highway between Adana and Mersin. The Deliçay, which lies not far east of Mersin, transports boulders up to two feet in diameter to within five miles of the coast. The low, flat part of the deltaic plain is narrow and sandy in this western region. Coastal beaches have a much higher content of gravel and are relatively steep and firm at the shore. A range of about 5 feet between higher and lower stands of the Mediterranean is evident along steep beach fronts.

Strabo brings the river Cydnus through the middle of the city of Tarsus and has it empty into a lake, the Rhegma, which determined the site of an arsenal and naval station.[20] According to Ramsay,[21] the Romans had converted Rhegma, which was originally nothing more than a wide place in the river, or useless lagoon, into a harbor that permitted Tarsus to outstrip its chief rival, Mallus, near the mouth of the Cey-

[20] 14.5.10.

[21] *Op. cit.*, 1903, pp. 364–365.

han, which had served as the main port for Lower Cilicia during Greek times. During the sixth century the Tarsus (Cydnus) was diverted artificially to the position it now occupies, to the east of the city. Byzantine and Moslem times witnessed the complete decline of the old harbor, which today lies in a marshy flat that is subject only to occasional flooding. By the fourteenth century or so it became a rare occurrence to find waters flowing along the old channel through the city during floods, but even today there is occasional use of the ancient stream course. The newer channel to the east has functioned long enough to develop a modest set of meanders between Tarsus and the sea.

Mounds containing stone knives and artifacts that in some cases suggest extremely ancient origin, possibly from pre-Hittite times, are numerous in Lower Cilicia. Some occur on the bedrock or on Quaternary surfaces above the deltaic plain and many were erected on the plain itself. A penetrating study of these mounds would undoubtedly shed much light on the development of the compound delta from the chronological standpoint. That the Rhegma of Tarsus was really inland, and not a coastal harbor as many classical authorities suggest, is indicated by the presence of several mounds to the south, near the coastal dunes. There is a large area between the lower Cydnus and Sarus, however, which appears to be free of mounds. The probability that considerable embayment existed to the west of the lower Seyhan appears unlikely, as physical evidence is against it. It seems more probable that Seyhan floods reached the lower flats of the area frequently enough to discourage mound building, and that farther west, where the surface has comparatively steep gradients, smaller streams were depositing coarse alluvium at a prohibitory rate. The greatest density of mounds, as of villages today, occurs along the natural levees of the Ceyhan-Seyhan plain. There are few distinct natural levees in the moundless area to the west. Except toward the coast, where the hazards of floods were at a minimum, most of this region appears to have been avoided by the mound builders.

The Ceyhan resembles the Seyhan in size and most regards, except that it wandered less freely over the deltaic plain for the reason that active faulting tended to trap its courses in the proximity of the hills between the town of Ceyhan and the village of Bebeli. These hills display many scars of Ceyhan impingement against their lower slopes, and for long distances are flanked by marshes which have been localized by rotation of the downthrown, delta, block as it has been displaced below the adjacent bedrock of the hills. Basins where tall reeds flourish and which might be occupied by permanent "rim-swamp" lakes were the annual rainfall heavier are bounded eastward by the hills and westward by natural levees of the Ceyhan. Now and then the river has been diverted into one of these basins, to scour scars of impingement against the hills.

The broadly wandering Seyhan has generally developed long and relatively simple meander loops, whereas the restricted Ceyhan displays the effects of intensive meandering, with much greater complexity in channel history, along a narrow meander belt. During floods the overflow waters of the two rivers often mingled

along their common backswamps. The village of Sazak maintains a tradition that a rather extensive basin nearby is the true meeting place of floods. This backswamp stands low and is too damp for the growth of trees. Its heavy, clayey soils are too fat for agricultural development. Farther downstream, about 6 miles north of Bebeli, an ancient Seyhan channel barely missed joining the Ceyhan (Fig. 11). Still farther downstream a junction actually occurred, in a course leading toward Akyatan.

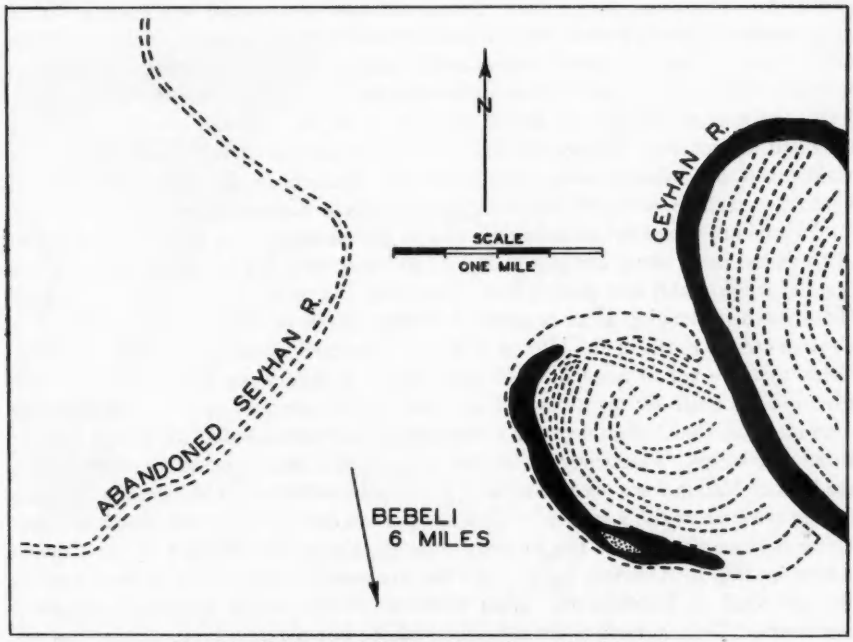

FIG. 11. Seyhan and Ceyhan channels north of Bebeli.

CEYHAN DIVERSIONS

The earliest surface trace of the Ceyhan along the north side of the Miocene hills between Bebeli and Karataş leads to the Dalyan passage to the Mediterranean, at the eastern end of Akyatan. Toward the western end of the hills, near the village of Kuçuk Karataş, are remnant channels with bends of size and sharpness appropriate to the Ceyhan. These appear some distance west of an interesting bridge on the Adana highway north of Karataş. The channel under the bridge is a modification of the ancient Ceyhan courses caused by Seyhan appropriation at some later date. This channel is straighter and simpler in pattern than the old Ceyhan channels, and it may be followed upstream and northward to the proximity of the existing Seyhan about six miles south of Adana (3 in Fig. 8).[22]

[22] Sir Charles Wilson, in discussing Ramsay's paper of 1903, stated that Colonel Bennet

The sequential changes in channel history north of Karataş begin with the Ceyhan following that route to the sea, and today the channel remnants near Kuçuk Karataş preserve evidence of this original Ceyhan route. Later, the Seyhan experienced a diversion which directed it along the eastern part of its flood plain, and southward toward the Miocene hills, where it entered the Ceyhan. The lower course of the combined rivers was straightened and widened. This may have been the condition at the time of Strabo, when it was reported that the next river mouth east of the Tarsus was the Ceyhan. Somewhat later the Seyhan was again diverted at an upstream point, toward Adana, into a route well to the west. This may have been the case a century after Strabo, and the reason why Ptolemy specified a mouth for each river. Finally, there was a diversion of the Ceyhan from the Dalyan outlet to one east of the hills at Bebeli, so that all of the channels north of Karataş were left abandoned. These channels back of Dalyan are now tidal inlets that remain damp and salt-encrusted throughout the summer, so that they form serious barriers to traffic westward from Bebeli to the Adana-Karataş highway.

Diversion of the Ceyhan to outlets east of Bebeli came quite late. The alluvium of the flood plain along the gap at Bebeli and eastward has developed soil profiles that are considerably less mature than those along the course leading toward Dalyan. Most maps portraying local geography during Greek or Roman times indicate a Ceyhan course north of the hills at Karataş. Strabo[23] quotes an oracle as saying, "Men that are yet to be shall experience this at a time when the Pyramus of the silver eddies shall silt up its sacred sea-beach and come to Cyprus." Behind this is an idea that the Ceyhan deposits a tremendous amount of sediment, which, indeed, is the case today. Practically all writers on ancient Cilicia express the opinion that the hills of Mallus were once an island; Sir Charles Wilson would have it so remain during the time of the ancients.[24] The designation of Cyprus by the oracle is interesting because that island lies to the southwest, along the direction of the Ceyhan course leading to Akyatan, rather than the diversion course which leads eastward, into the Gulf of Iskenderun. With reference to the oracle quotation, Anthon[25] comments, "This, however, has not taken place; but a remarkable change has occurred with respect to the course of this river, which now finds its way to the sea, twenty-three miles more to the east, in the Gulf of Scanderoon." This distance is the airline separation between Dalyan and a place as far along the Ceyhan channel leading toward Yumurtalik Harbor (Ayash Bay) as it might be presumed the river mouth was located a little over a century ago. It exceeds considerably the coastal distance from Dalyan to any part of the coastal plain south of Bebeli. It therefore appears probable that the diversion reported by Anthon was the one near

traced an ancient Sarus channel into the Pyramus in the early 1880's. It was most likely this same channel, which is not only distinct in the field but also at most places is quite accessible to the main road south from Adana.

[23] 12.2.4.

[24] *Op. cit.*, Ramsay, 1903, p. 410.

[25] *Op. cit.*, p. 1151.

Bebeli, across the gap between the Miocene hills of Karataş and older hills to the north.

Ramsay[26] is quite definite in dating the Ceyhan diversion at Bebeli. Originally "the Pyramus flowed on the west side of the little isolated ridge of [Miocene] hills on which Mallos was situated. Afterwards, during the Middle Ages, it changed its course, and now it hugs still more closely the edge of Jebel-Nur [Cretaceous and Miocene hills], creeping around until its mouth flows back to the east in the bay of Ayash, which it is rapidly filling up."

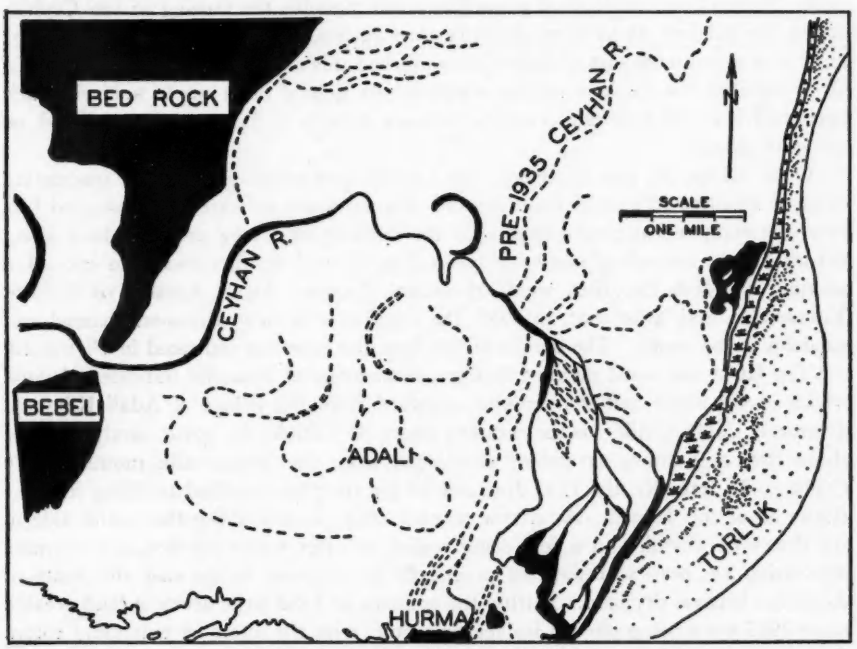

FIG. 12. Ceyhan diversion of 1935.

Ancient writers all place Mallus on the left side of the Pyramus. Strabo[27] implies a coastal location on a height near the river mouth, and Greek coins indicated that the place was a port, though some authorities would place it inland, and Scylax, according to Ramsay,[28] said it was close to the sea, but faced inland; all of which led Ramsay to conclude, "The actual site of Mallos has not yet been discovered: it will be found probably on the northern slope of the ridge of hills not far from the village of Kara-Tash." Indeed, the site of Mallus must lie on the hills immediately to the rear of Kuçuk Karataş where there are many ruins, dating from various periods.

[26] *Op. cit.*, 1903, p. 361.
[27] 14.5.16.
[28] *Op. cit.*, 1903, p. 361.

The whole surface is riddled with scars of accelerated erosion, along old paths and roads, and some have developed into ravines which lead back from Karataş. Megarsa, which at times has been mentioned as the true port for Mallus, lay on the right bank, and hence appears to have been located beneath what are now the sand dunes just west of the Dalyan outlet of Akyatan.

The hills between Karataş and Bebeli were rather deeply eroded during low stands of Ice-Age seas, and their steep-walled but flat-floored valleys evidence conspicuous alluvial drowning. A saddle north of Bebeli was the lowest gap between Karataş and Misis, and proved to make possible the cutting of the Ceyhan across the hill belt, so as to establish eastern outlets. It is unlikely that headward erosion of any stream east of Bebeli accomplished this as a feat of stream piracy. In all probability the Ceyhan simply alluviated its deltaic plain up to a level which permitted it to find a diversion course through the gap at the time of some flood, or series of floods.

Once across the gap at Bebeli, the Ceyhan proceeded to build an interesting delta of its own. Though numerous old channel scars indicate a complicated history, the main recent events have been the building of a long prong of land along natural levees extending eastward (2 in Fig. 8) and northeastward to cut off a portion of Ayash Bay, just south of ancient Aegææ (Aigai, Ayash), or modern Yumurtalik, and, after that, in 1935, the creation of a new diversion channel and subdelta to the south. The details of this last diversion are indicated in Figure 12.

The latest and most detailed topographical maps of Anatolia indicate a lagoon which covers about half the distance eastward from the village of Adali Köyünda (formerly Adali Çiflik) to the western shore of Torluk, the great sandy tract of shore flats and dunes extending southward from the Yumurtalik mouth of the Ceyhan. In actuality, the 1935 diversion of the river has resulted in filling in practically all of this lagoon. A narrow marshy strip persists along the inland side of the dunes of Torluk and a few small bodies of open water survive, but crevasse alluviation has been so rapid that practically all territory to the east and south of Adali has become dry land. During the summer of 1952 large areas of land created since 1935 were being plowed for the first time, with the intent of extending cotton fields from the vicinity of Adali practically as far as Hurma.

The details of the present-day advance of the new subdelta of the Ceyhan into the Gulf of Iskerderun are illustrated by a sketch map made in the field in October, 1952 (Fig. 13). There was a striking color contrast between the brownish water rushing out of the river mouth and the blue sea which it entered. A pronounced westward set of the coastal current carried the sediment-charged river water around a bar which was being formed a hundred yards or so offshore. This transportation of sand was assisting the development of a beach to the west, which was growing outward, toward the new bar. The whole process observed as taking place was a repetition of events which had previously occurred, for there were three older beaches converging westward from points along the right bank of the river channel. These were spaced about one hundred yards apart at the river. Each of the old

beaches was distinct; marked by concentrations of shell. Each was considerably firmer under foot than the wedge-shaped areas of loose sand between them. Inland from the beaches was a belt of hummocks and low dunes, none of which was fixed or to any appreciable degree oxidized. This whole territory is fatiguing to walk across during dry weather, as the sand is loose and drifting. It is possible that every bit of land shown in the sketch had originated within the preceding five years, and that the cyclic nature of delta advance is related to seasonal river flooding. In any event, not only this area but several additional square miles to its north was either open sea or lagoon prior to 1935.

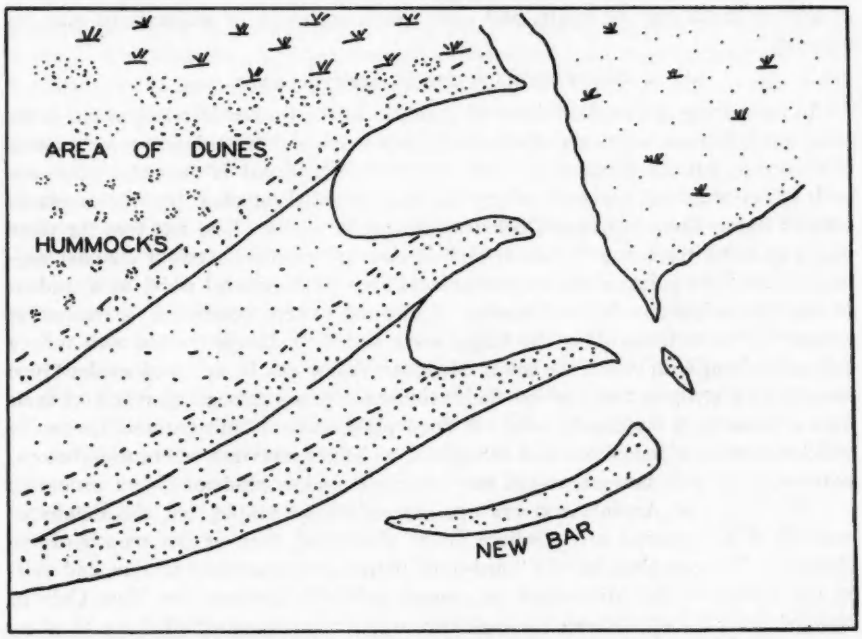

FIG. 13. Sketch of the mouth of the Ceyhan River, October, 1952.

PETROLEUM POSSIBILITIES

Most of the uplands surrounding the compound delta region of Lower Cilicia are Cretaceous or younger in age, and their structure suggests the presence of a considerable thickness of Neogene and Quaternary sediments below the alluvial plains. Hills rising in the delta region as a result of faulting suggest the possibility that a complicated structural pattern is associated with traps in which there may be a reasonable chance of finding commercial quantities of petroleum. Several exploratory wells have been drilled by the Turkish Geological Survey on locations determined geophysically. Until more borings are completed and the nature of

the sedimentary section is known more precisely, it seems unlikely that geophysical prospecting has any particular merit. It might be more effective, and certainly more economical, to study the warping of Quaternary surfaces in order to locate structural "highs" above possible petroleum reservoirs.

Four excellent Quaternary river terraces occur along the Koson River to the west of the village of Çelebi Manda, a short distance north of Tarsus. Widespread terraces occur along the Ceyhan in the vicinity of Misis and eastward. The contact between the youngest Pleistocene terrace and the overlying Recent alluvium follows roughly the highway from Mersin to Misis, keeping to the south at most places, so there is an adequate area of Lower Cilicia where detailed determinations of terrace levels may be made, and over which warpings or dislocations may be detected.

COMPARISONS WITH MISSISSIPPI RIVER

In comparing the smaller rivers of Anatolia to the Lower Mississippi one finds many resemblances, and some distinct contrasts. Alluvial drowning of river mouths is universal, but the distinctness with which it is displayed in Anatolia surpasses such evidence as the low walls along the Mississippi flood plain provide at places such as Baton Rouge, or near Opelousas, across the valley. The fact that the river which gave us the term, "meandering," braids and exhibits straight channel segments at various points along its course would not be considered novel by a student of the Mississippi; in fact the variety of channel pattern conditions is modest in comparison with those along the larger river and their absence might well reduce the enthusiasm with which the lower Meander Valley can be accepted as the "type locality" for streams that fashion their winding courses through alluvium of their own creation in a systematic way. A flood plain without both coarse alluvium in which channels widen, shoal, and straighten, and finer alluvium where they become narrow, deep, and sinuous, would not be typical of low-gradient rivers generally.

The deltas of Anatolian rivers are comparatively simple, but the details of creating delta patterns are nowhere better illustrated than at the mouth of the Sakarya. The complexities of a "bird-foot" pattern are practically unique, and exist at the mouth of the Mississippi at present primarily because the New Orleans channel leads a long distance through clay which was deposited offshore or along marginal lagoons of older deltas. This clay "fixes" the channel and prevents active development of meander loops for over 100 miles, so that normal distributary patterns are to be found only well downstream, below Head of Passes, where the talons of the bird-foot occur. Older deltas of the Mississippi were more the size and shape of the Nile Delta, with similar, radiating distributaries. Anatolian deltas display this pattern only modestly and imperfectly, because they are small.

The greatest contrast between the Mississippi and Anatolian rivers arises in the development of clay plugs along the larger stream. These accumulations of silt and clay in sites of old cut-off lakes are practically unerodible, and as they occur well out toward the right and left limits of meander belts, have the effect of confining the Mississippi, much as livestock is held between the fences of a lane. Diver-

sions have been few in number during the last twenty centuries, so the Mississippi has a very small number of meander belts. It is quite impossible for the smaller rivers of Anatolia, or smaller rivers in general, to develop such definite meander belts. Even were fine materials available for filling the old cut-offs, the size of each clay plug would be small, and it is unlikely that major diversions would occur so infrequently that a whole series of clay plugs could ever develop with sufficient continuity to outline a meander belt within the confines of their route downvalley. This is the case along practically all of the Lower Mississippi today, the only exception of consequence being a stretch of twenty miles or so above Old River, where no clay plug exists to prevent westward development of meander loops and the possible diversion of the Mississippi into the Atchafalaya course to the Gulf of Mexico. The Meander and other Anatolian rivers have been diverted freely, even to opposite sides of their valleys. Smaller rivers are likely to change their routes without difficulty after alluviating districts along old courses to a degree where natural levees rise to heights that create an imbalance in topographic equilibrium. Few rivers have migrated more freely than the Seyhan. Its alluvium is at once fine enough to prevent the development of an uncertain, anastomotic route to the sea, and yet coarse enough to prevent entrapment in a fixed channel, such as the Mississippi follows between Baton Rouge and Head of Passes, first in Pleistocene clay and later in delta clay. The Seyhan's meander loops, even if developed in fine sediments, are too small to originate belts of clay plugs that could hold a meander belt in place.

Tectonic control of river channels occurs both in the Lower Mississippi Valley and in Aanatolia, but is much more evident in the latter. The Ceyhan and the Lower Meander cling to valley walls because fault offsets tilt valley margins toward adjacent hills. The Lower Mississippi exhibits tectonic control in gross patterns, in establishing the directional trends of segments much longer than the space required for several meander loops. It is for that reason a generally straight course between Baton Rouge and the Gulf exists at the present time.

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THE ASSOCIATION AND THE ANNALS

The Association of American Geographers was formally organized in Philadelphia on December 29, 1904, following plans earlier reached at meetings of the American Association for the Advancement of Science, and the Eighth International Geographical Congress. Leading objectives of the Association are the encouragement of original research and the publication of studies in geography and related fields.

The ANNALS was instituted in 1911 to stimulate scholarship and to provide a medium for the exchange of findings. Its volumes contain professional work of members and other contributors, presidential addresses and abstracts of papers delivered at annual meetings, occasional committee reports of general interest or importance, and symposia on topical and regional themes.

The September and December numbers of 1939 (Vol. XXIX) comprised Richard Hartshorne's monograph, "The Nature of Geography," a significant work which was later reissued as one volume. Continued demand has exhausted a second printing (1946) and a third printing (1949). A fourth printing is now available (Sept. 1951) at A.A.G. Central Office, Map Division, Library of Congress, Washington 25, D. C.

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